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RC MICROFLIGHT NEWSLETTER
... see page 51

MODEL Airplane NEWS

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MODEL Airplane NEWS

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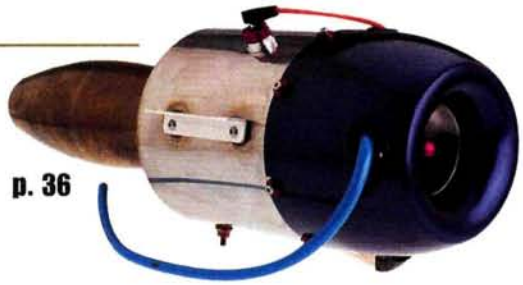
JANUARY 2000 • VOLUME 128, NUMBER 1

MAIN COVER IMAGES: this painting of a P-47 Thunderbolt by the late Jo Kotula graced a previous cover of *Model Airplane News*. Do you know which issue it was? Mail your answer to: Jo Kotula Cover, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Email entries are not valid. We will draw five names out of the first 50 correct answers and give away free, one-year subscriptions.

Features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Construction

Reviews


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Columns

Departments


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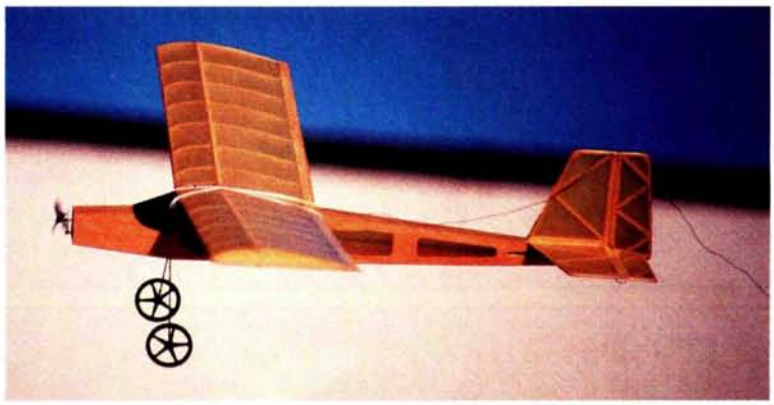
RC MicroFlight

We are proud to announce our newest publication: *RC MicroFlight*, a cutting-edge, 16-page, monthly newsletter that debuts in "sampler" form inserted in this issue, beginning on page 51. The result of an alliance between *Model Airplane News* and John Worth's *Cloud 9* newsletter, *RC MicroFlight* aggressively investigates the fast-developing new arena of affordable, fully controllable miniature aircraft. Backyard flyers have arrived, and *RC MicroFlight* is where you will find the latest information on this fascinating new segment of our hobby.

Written by experts in the field, *RC MicroFlight* will be delivered in print and by email. The newsletter is complemented by a multimedia website (www.rcmicroflight.com) that offers even wider coverage of the subject, including MPEG videos of micro flyers in action and much more. The first two issues, dated November and December 1999, will be available free online. Check out the website and the free sample bound into this issue of *Model Airplane News!*



Tom Herr's 3.5-ounce StarLite backyard flyer, featured in this issue's* RC MicroFlight *insert, can fly for 10 minutes on 8 Ni-Cd cells and for more than 2 hours on lithium batteries. The technology used in this little plane is readily available.

BACK TO THE FUTURE

Now that the year 2000 is upon us, modelers everywhere are asking: what new technology will the next few decades bring? Noted contributors Bob Aberle and Dave Gierke share their insights in "The Future of RC: a New Millennium in Modeling." Is a fuel cell-powered electric or a talking RC transmitter in your future? For more on the technology of tomorrow, see page 42.

Speaking of high tech, for the last month, the editors of *Model Airplane News* (and its sister publications *RC Car Action* and *RC Boat Modeler*) have been vying for stick time on the Great Planes *RealFlight Deluxe*, the newest flight simulator to hit the market. We have been practicing everything from takeoffs and landings to advanced aerobatics. Impressively, the latest version offers a new, sophisticated helicopter simulation and an even greater variety of aircraft. Read our review of *RealFlight Deluxe* starting on page 64, and see what all the fuss is about.

Powered by two RAM 750 turbines, Kent Nogy's BVM Rafale is an awe-inspiring machine. Rich Uravich's "Spooling Up" article explains the technology behind turbine power.

On the faster—and more powerful—end of the modeling spectrum are jet turbines. Master modeler and jet expert Rich Uravitch provides straight talk on these sophisticated yet simple machines in "Spooling Up" (page 36). Besides explaining the basics of turbine design and operation, Rich takes a close look at 12 of the most popular units. If you've ever been mesmerized by the sound of a turbine-powered jet model on a flyby, this article is a must-read.

Attention scratch-builders: are you looking for a winter construction project? Whether you're inclined to build small, sport electric models, giant-scale warbirds or ducted-fan jets, we're sure you'll find it in this month's bonus "Plans Directory," which includes 300 of our most popular published designs. And when you're ready to take that finished plane to the field, remember to take along your camera so that you'll be able to send us a photo or two!

As we enter the 21st century, more RC modeling options are available than ever before. Since its inception, RC has been the driving force behind many advances in technology, so hold on to your hats; the best is yet to come!

AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," MODEL AIRPLANE NEWS, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous number of letters we receive, we can not respond to every one.

BACKYARD FLYING

In the November '99 issue of *Model Airplane News*, Tom Atwood wrote an editorial about backyard flying. A picture was shown of a small model airplane, DeltaSTAR 500, designed by WES Technik of Germany and distributed in the U.S. by David Lewis. The article goes on to say that one was built by contributor Russ Pribanic, but nowhere does it tell us where to purchase one of these little planes. Please give me a phone number, address or better yet, an email address for the company that sells them. [email]

TERENCE EVERETT

You're not alone, Terence; the photo of the WES Technik DeltaSTAR 500 has generated a lot of interest. Check out David Lewis's website at www.homefly.com for more information on slow flyers. David's email address is dlewis@usginteriors.com; his postal address is 4027 Rocky River 26, Cleveland, OH 44135-1147; (216) 251-2517. DS

MAIL CALL

The "How-to" article in your May 1999 issue featured a really neat customized mailbox that looked like a Piper Tri-Pacer. There was also a photo of a mailbox made to look like a DC-9. I was really impressed!

As I drove down my street, I noticed various new mailboxes (commercially made), and when I got home, I was ashamed of my 30-year-old mail canister. Inspired by the custom airplane mailboxes in the article and as a longtime scale modeler, I decided that my next project would be a mailbox that I could be proud of.

After sketching and considering many designs, I chose a "sort of" Gee Bee. I bought a new mailbox and made a metal post to mount it on. From my drawings, I shaped the front end, rear fuselage and wheel pants out of blue foam and covered them with fiberglass. The flat parts are ¼-inch-thick tempered masonite coated with epoxy resin. The Gee Bee mail plane was painted with Rustoleum enamel.

Needless to say, I am quite proud of my new mailbox, and my neighbors think it's really special.

DARRELL ROHRBECK
Harrison Township, MI

Thanks for sending us a photo of your latest project, Darrell. We'll bet it's the nicest mailbox on your block! DS

BALSA ABCS

In your November '99 "Airwaves," David Kummer asked a question about wood weights. I have to disagree with the part of your response that indicated the "ABC" system was related to wood weights. Most free-flight modelers know that this is not the case. The "ABC" system is intended to describe the grain structure of the wood, not the weight. Also, the "ABC" system refers to how that piece of balsa was sliced out of the original log. I have some really light (4-pound density), "C"-grain wood that I use for tail surfaces on indoor, hand-launched gliders; I also have some fairly heavy (10-pound density), "A"-grain wood that I use for the fuselages of hand-launched gliders. The possible combinations are nearly endless.

The "ABC" system is great for deciding what kind of wood to use for a specific part of a model: "A"-grain balsa has a long, linear grain structure and is easily bent along those grain lines. Choose it if you need to bend your wood into a curve, as for leading-edge sheeting. "B"-grain balsa has shorter grain lines and might be a bit mottled. It is stiffer than "A"-grain wood but still somewhat flexible along the grain. It works well for fuselage sides and other general uses. "C"-grain balsa is very mottled, has no visible linear grain structure and is quite stiff. It's a great choice for parts you don't want to bend, such as ribs or formers. I hope this clarifies the "ABC" system. [email]

DENNIS WEATHERLY

Dennis, thanks for setting us straight. In my oversimplified explanation, I inadvertently confused wood weights with grain orientation. I'll update my reference material. GY

DESIGN CONTEST UPDATE

When *Model Airplane News* announced its 4th RC Design Contest on page 86 of the November '99 issue, a printing glitch caused the last few lines of type to drop off the page. It should have read, "By June 1, 2000, send us pictures of your model, both on the ground and in the air (under its own power) as well as a specification sheet. You or your team must have built the plane yourselves." The rules as printed on the right-hand side of the page are complete, but if you have questions or comments about the contest, please feel free to email us at man@airage.com or call us at (203) 431-9000.

A few of you have asked whether models designed after full-size planes are eligible; yes, they are. We look forward to receiving your entries!

New products and people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will at times cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

AIR SCOOP

BY CHRIS CHIANELLI

Ziroli at Warbirds Over New York

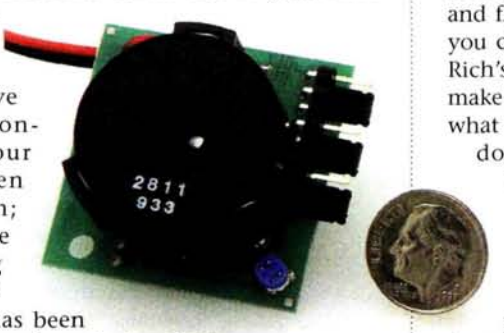
None other than the master himself, Nick Ziroli, attended the first 518th Squadron "Warbirds Over New York" meet with his pretty 1/4.5-scale, 80-inch-wingspan Ercoupe (military YO-55 or XPQ-13). The design weighs in at 16 pounds and has a three-piece wing with 985 square inches of area; its power requirements are a G-23 ignition and .90 2-stroke or 1.20 4-stroke; Robart scale fixed gear are available. For rolled plans, contact Nick Ziroli Plans, 29 Edgar Dr., Smithtown, NY 11787; (516) 467-4765; fax (516) 467-1752.

The other photo is an aerial of the fantastic site where the meet was staged. This was a fun, low-key event replete with manufacturers' booths, full-scale warbird flybys, food vendors, plenty of parking, lots of RV space and a wide-open area for relaxed flying. I took along my Hangar 9 PT-19, and I had a ball. And any size of warbird is welcome at this event. The next meet is scheduled for the last weekend in July 2000. If you want to have fun, I highly recommend it. Oh yes; all proceeds go to the Bethlehem, NY, DARE program.

For more information, contact Bill Steffes at (518) 452-7722 or Vic Olivett at (518) 475-0942, or email Vic at volivett@worldnet.att.net.

The Plane Saver

Here's one of those little "why didn't somebody think of this before?" gadgets. The new, onboard LED voltmeters are wonderful innovations, but what if you don't want to ruin your plane's appearance? Check out the Plane Saver. This 11-gram unit operates completely out of view and audibly performs five functions: it confirms that your power has been switched on; checks airborne voltage during start-up; checks whether there has been an unsafe voltage drop during flight; serves as a fuel timer; and emits a lost-plane alarm for up to one hour. This clever little 1.5x1.5-inch package alerts you by using 12 different tones (do, re, mi, fa ...) for its various functions. The tones can be heard up to 1/4 mile away! (and they're remarkably effective at irritating coworkers).



Distributed by Anchor Seal, 16 Riverside Ave., Danvers, MA 01923; (978) 774-5217.

Bronco fit for a King

Rich Uravitch certainly knows how to design them so they build easily and fly right. There are few things you can do to improve on one of Rich's designs—except, maybe, to make one bigger! And that's exactly what "The King," as I call him, has done. Hot on the success of his original OV-10 design, Rich has drawn up a new, 81-inch-span, balsa-and-ply version for a pair of .46 to .60 2-strokes. At its 12-pound design weight, the warbird works out to a very manageable 22.7 ounces per square foot. wing loading. The Bronco calls for a minimum of four channels; flaps and retracts are optional. Rich's OV-10 will be the subject of an upcoming *Model Airplane News* construction article that will have all the details about plans, formed parts, etc.

WINNER! Recycle-air CONTEST

Here's recycling brought to a whole new level—or altitude. Don Incoll, of Healesville, Victoria, Australia, caught my August "Scoop" regarding the B.C. Originals RC can contest. With a bit of engine-uity, Vic picked up a five-year extension to his *Model Airplane News* subscription. That's not bad, considering he would have only received $2.30 if he had returned the cans to the store! Yes; Don supplied me with the requisite video of flight duration longer than 100 yards, and judging by what I viewed, it flew quite well! He calls his plane "Things," as in "Things go better with Coke®." And if you're feeling as creative as Don, 46 seems to be the magic number: 46 cans, 46-inch wingspan and .46 Thunder Tiger engine. The all-up weight of his un-can-ventional aircraft is 5.5 pounds; would it have been heavier if he had used Classic Coke cans instead of Diet?

Combat Corsair

The hits just keep on rolling!—both in the air and out of the hangars at JK Aerotech. If you haven't seen or tried 1/12-scale combat yet, I'm telling you, it can bring the fun back to your field! This is JK's new, 3-channel foamie Corsair that features its typical CNC hot-wire-cut, pink foam structure and Coroplast tail-feather design. This 41-inch-span, 2.5-pound sport/warbird is designed for a .20-size glow engine or comparable geared electric for solid performance. The fuselage is large enough to tuck most radio gear beneath the "canopy" in the usual cut-pocket style. JK Aerotech includes the pushrods, control horns and one roll of colored tape in the $35 kit. You're responsible for raiding the laundry room for a half-gallon bleach container to make the cowl.

JK Aerotech, 10800 SE Orient Dr., Boring, OR 97009; (800) 442-6755; (503) 663-0464; fax (503) 663-1351.

Phase 2

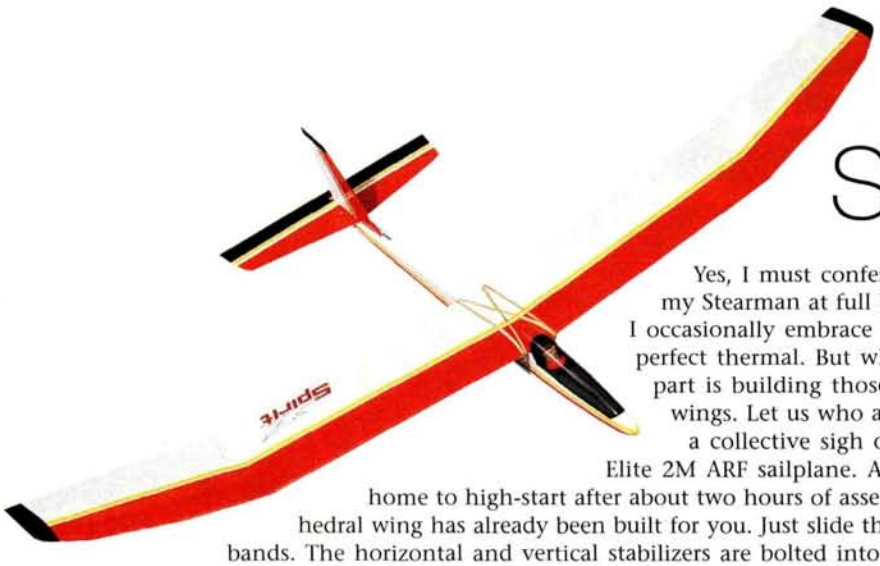
Hmmm ... your resolution this year was to be different; to stay away from the boring, basic, "me-too"-type designs and make a showing at the field with something unique. OK; grab your .60 and dial up the gang at Leading Edge Model Aircraft. This is its prototype Phase 2, which is scheduled to be released in kit form in spring 2000. It features all-balsa construction and a 64-inch-span, fully symmetrical wing, and it calls for a .60 2-stroke. Based on the prototype's aerobatic capabilities, the folks at Leading Edge feel they have a winner on their hands, so you'd better get on the waiting list because a lot of people want "something different."

Leading Edge Model Aircraft, 17 Boxwood Rd., Port Washington, NY 11050; (877) 431-3183.

In the Doghouse

So, you were gonna put up *one last flight*, right? And now here it is, half-a-fuel-jug later; you're gonna be in trouble back home, big time! I think this Dick Smith design is so named because it's so much fun to fly, you don't want to go home. According to D&L Designs, the model delivers great "hot-dog"-style performance with its generous control surfaces yet has slow, predictable landings. The all-wood kit includes rolled plans, a 20-page instruction manual and 73 photos to aid the construction process. If a wide performance envelope in a .40-size sport plane appeals to you, you might want a Doghouse in your hangar. Specs: wingspan—54 inches; wing area—675 square inches; weight—5.5 to 6 pounds; wing loading—18.75 to 20 ounces per square foot.

D&L Designs, 1145 E. Kleindale Rd., Tucson, AZ 85719.



Soar Subject!

Yes, I must confess; there is more to modeling than running my Stearman at full bore on a low, inverted show(off) pass. Even I occasionally embrace those quiet, relaxing times in search of the perfect thermal. But what interferes with the "quiet and relaxing" part is building those annoying, tapered, poly-obnoxious glider wings. Let us who are among the balsa-semi-challenged breathe a collective sigh of relief: Great Planes has released its Spirit Elite 2M ARF sailplane. According to Great Planes, you can go from home to high-start after about two hours of assembly! The all-wood Spirit's triple-taper, polyhedral wing has already been built for you. Just slide the two halves together and attach the rubber bands. The horizontal and vertical stabilizers are bolted into place for proper alignment and easy transportation. For more precise speed control and landing accuracy, Great Planes has incorporated optional spoilers within the inboard wing panels; they can be made functional by adding a third channel. The sailplane is covered with an attractive and highly visible four-color MonoKote trim scheme. What's left for you to do? Install your radio gear, paint the included cockpit and pilot figure and go find some lift! Specs: wingspan—78.5 inches; weight—2 pounds; length—39 inches; wing loading—7 ounces per square foot.

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008.

YELLOW AIRCRAFT

Quality in ARFs

Yellow Aircraft, which has a reputation for producing very high-quality ducted-fan and prop-driven fiberglass kits, now offers ARFs. According to Yellow, its new line of ARFs is manufactured by the same factory as produces its kits, and these ARFs will maintain the high standards of quality that the company has always met.

The Sukhoi SU-31M, Extra 300L and CAP 232 pictured here will be available in both .60 and 1.20 sizes. They're of all balsa and ply construction, and the major components are covered in MonoKote. The fiber-reinforced plastic cowl and aluminum landing gear have been painted for you, and a full complement of hardware, spinner, engine mount, vacuum-formed canopy, fuel tank, linkages and attractive, fuelproof decals is included. The .60-size version ($249) has a 60-inch wingspan and weighs approximately 7 pounds, and the 1.20 version ($379) has a 72.5-inch span and weighs in at 11.5 pounds. Spies in the field report that the trio live up to the reputation of their full-size counterparts' aerobatic capabilities but are very stable when they're low and slow.

Yellow Aircraft, 203 Mass Ave., Lexington, MA 02173; (781) 674-9898; fax (781) 674-2288.

SUPERMAN JET RALLY

Above: CAI is a new company that's dedicated to sport- and scale-model jet kits. Here is its lineup of Raptors detailed in sport and military schemes. Most are set up for AMT turbines, but they can be powered by other turbines as well.

What does JR think of the jet industry? Judging from the appearance of Kent Nogy's BVM Rafale, quite a lot! More than $15,000 went into this brilliant demo model; it's powered by two RAM 750 turbines.

Every year, thousands of jet-model enthusiasts invade the little town of Metropolis in southern Illinois during the first week of October. To many, Metropolis is the home of Superman, but to these jet modelers, it's the home of the Superman Jet Rally. This event has become one of the largest RC airplane "jet-togethers" in the world; the most recent event drew 245 pilots and 26 manufacturers, who displayed the very latest in jet-model technology. In four days, at six flight stations, more than 800 flights were logged.

Ducted-fan and turbine-powered aircraft flew continuously, but it was the turbine models' roaring that grabbed most people's attention. Futuristic, all-composite jet kits, space-age electronics and exotic turbines were the norm; they were proudly displayed and demonstrated to the mass of spectators. Everything from entry-level aircraft to exquisite scale models was on hand, to be seen and to be touched. Amazingly, the supply of many expensive, highly advanced kits was sold out before the gathering ended! Factory teams from Airtronics, AMT, Air Magic, BVM, CAI, Century Jet, Golden West Models, JR and RA Microjets were there in force. These teams spent thousands of work hours and untold dollars preparing special demo models to woo current, new and rejuvenated modelers.

Today's jet pilot is successful, intelligent and ready for these sophisticated models. Many have recently become reacquainted with aeromodeling, especially since the sound, smell and performance of turbine engines have become a reality. There were plenty of jets to choose from at Superman. Many manufacturers who were there said that an event such as this does more for the jet market than any indoor hobby trade show. I think it's true because at events such as Superman, a prospective buyer can not only inspect a product up close but also observe its performance in the air.

—Frank Tiano

Right: turbine engines are far easier to install than many ducted fans. This promotes scratch-built projects such as this 94-inch-span, 20-pound Vantage—a Burt Rutan design built by Paul Appelbaum and powered by a RAM 750.

Left: Wolfgang Klur came all the way from Germany with his FiberClassics World Jet Masters-winning MiG 29. The model is powered by two AMT turbines, weighs 50 pounds and won Best of Show and other special awards. This unlimited production machine sells for $6,500! Right: you want new? You want quick? Bob Lindstrom poses with the Avons F-104—just 19 pounds and powered by a RAM 750 turbine.

PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

SILK PURSE

Corey Cook's Sig Hog biplane makeover could dress up a lot of other models, too. He wanted a unique look for its front end, so to create an unusual, streamlined outline, he adapted a fiberglass RV-4 cowl. He reports, "It's a nice flying airplane!" Look for it over San Diego, CA.

T-TWIN

Oklahoma City's John Giles writes: "There's just something about the sound of a twin that gets my heart pumping," and he shares this picture of his 10-pound 1938 Westland Whirlwind replica with us. The semi-T-tail Westland is pulled by a pair of HB .40s with 10x6 propellers and is supported by Kraft retracts. John reports that the plane is very fast and a real joy to fly.

GARY'S BEST BUD

Gary Pierson of Oakland, IL, proudly shows off his award-winning ⅓-scale Lanier Laser 200. The 4.8ci Brison-powered aerobat weighs 25 pounds, is completely covered with MonoKote and has LustreKote painted graphics—no decals. When this picture was taken, the big Laser had just earned Best of Show and People's Choice awards at a local mall competition.

THIS PUP IS NO DOG

This Balsa USA ⅓-scale Sopwith Pup is the handiwork of Bruce Goward of Indianapolis, IN, and it's only his second model. You'd never know it, though, considering all the fine details he has included. The G-62-powered warbird has an onboard starter, stitched-leather cockpit interior, flying wires, formed-aluminum access hatches and more. Covered with Super Coverite, the model has complete rib-stitching and was also finished with Krylon paints.

FATHER-AND-SON FUN

Here's 11-year-old Corey Marek of Renton, WA, and his first airplane. He helped his dad design and build the 4.75-pound, 65-inch-span, 3-channel, MonoKote-covered plane. Corey writes, "Taking off and flying is cool, but some landings can be awesome."

MAPLE LEAF MODEL

First flown in 1945, this DHC-1 Chipmunk was used primarily as a trainer for the Royal Canadian Air Force. Both the full-scale aircraft and the model have excellent aerobatic capabilities, according to Bill Weins of Vernon, B.C., Canada. Weighing in at 32 pounds—the addition of 3-pound floats is optional—this plane is powered by a SuperTigre 4500. It also features many scale rivets, a scale sliding canopy and a detailed instrument panel.

SUFFERIN' SUCCOTASH!

With Granny at the helm, Tweetie as copilot and Sylvester hanging on for dear life, Dick Stewart's Great Planes Super Sportster has made seven flights already. It's powered by a Zenoah G-62 and sports a Zinger 22x12 propeller. Tony Albence added the finishing touches with Ultracote Plus and auto touchup paint over the Ultracote and SuperShrink covering. Only a minor CG change was needed to get this plane airborne over Newark, DE.

MODIFIED P-51D

This Top Flite Mustang was built by Alex Wingate of Carrollton, MO, but it wasn't exactly done by the book. Alex added Robart retracts, almost 20,000 rivets and a US41 engine. He then scratch-built this dogfighter's sliding canopy, glass spinner, 5-inch propeller, guns and exhaust pipes, and he even put the diamond-pattern tread into the tires. All of the graphics were designed and airbrushed by Alex, and he even went to the trouble of giving the pilot a mustache made out of paintbrush bristles.

72-INCH DENNYPLANE JR.

Dan Owen built this plane using 4K plans. He added a K&B .28 engine and a Waco UPF-7 cowl that he obtained from Vintage R/C Plans. Shown here on the Redwood Empire Modelers Association's newest flying site in Klamath, CA, this plane "is a stable flyer and could be a good trainer," according to Dan. A Hitec radio, silkspan covering and Sig dope finish are also on the list of the Dennyplane Jr.'s features.

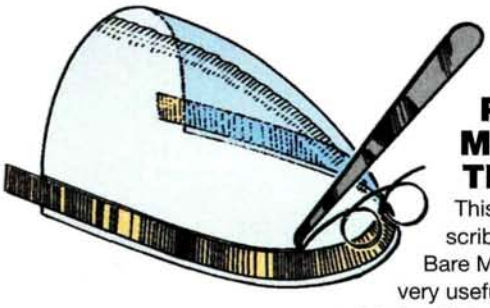
3, 2, 1, CON-TACT!

This P-51 is actually covered in Con-Tact paper, and according to builder Louis Goldberg, it "flies like a dream." A K&B .61 with a Perry pump pushes a 13x6 prop and gets this foam plane up to speeds of 75mph. Designed eight years ago in Rockville, MD, this Mustang weighs 14 pounds and has a 93-inch wingspan. You may not want yellow shelves, but this paper looks pretty good on a warbird.

HINTS & KINKS

BY JIM NEWMAN

SEND IN YOUR IDEAS. *Model Airplane News* will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



PLASTIC MODEL TECH TOOL

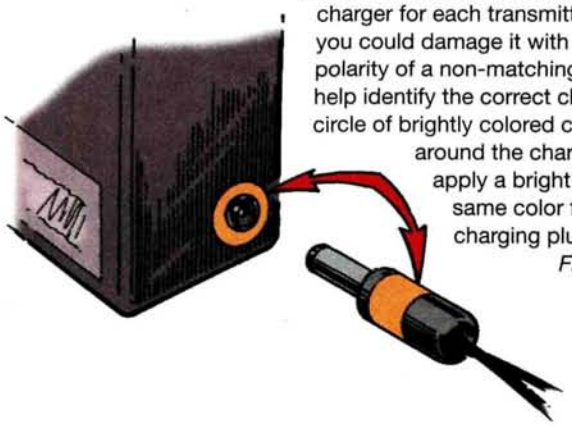
This plastic modeler's scribing tool from the Bare Metal Foil Co. is very useful for trimming molded parts because it creates a clean "snap line" after plowing out a thin, curly scrap of plastic. Outline the area to be trimmed with the hard, plastic label tape that's used in Dymo lettering machines, then use the edge of the thick tape as a guide.

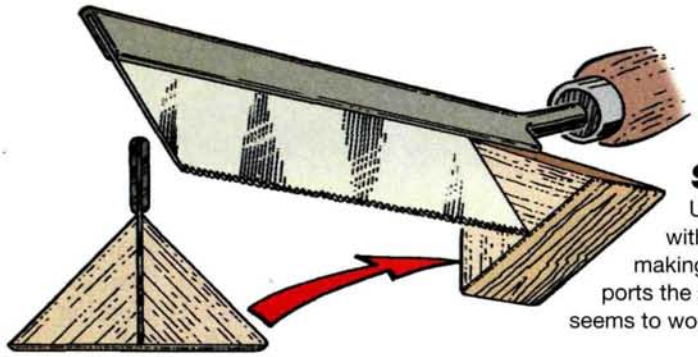
Colin Cameron, Grayslake, IL

MIX OR MATCH

If you have a mix of radios that need different charging jacks, make sure to use the correct charger for each transmitter because you could damage it with the reverse polarity of a non-matching charger. To help identify the correct charger, stick a circle of brightly colored covering film around the charge socket, and apply a bright band of the same color film around the charging plug.

Fred Heddleson, Oak Ridge, TN





SOFT SHOE SHUFFLE

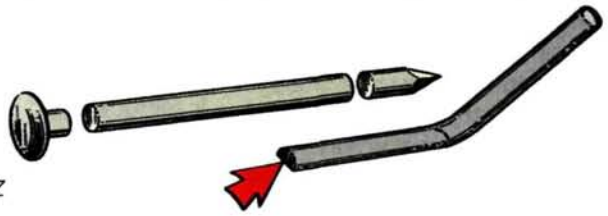
Use CA to glue 90-degree balsa blocks and a very thin ply shoe, with all its edges rounded off, to the end of your hobby-saw blade, making absolutely sure that it is at a right angle to the shoe. This supports the saw at a 90-degree angle while you cut fuselage spacers, etc., and seems to work much better than a slotted miter box.

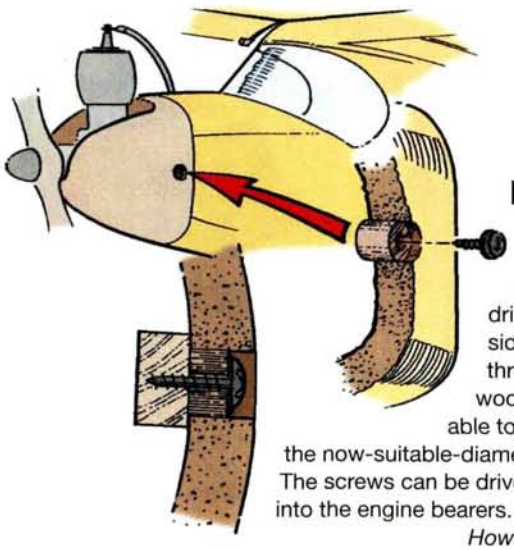
Eric Marsden, Horndean, Hampshire, England

CUSTOM TRIM SEALER

Cut the ends off large aluminum rain gutter nails, then bend, file and polish the resulting rods to make custom trim-sealer tools that can be inserted into your Top Flite trim-sealing iron.

Donal Kavanagh, Sun City West, AZ





EZ MOUNT COWL

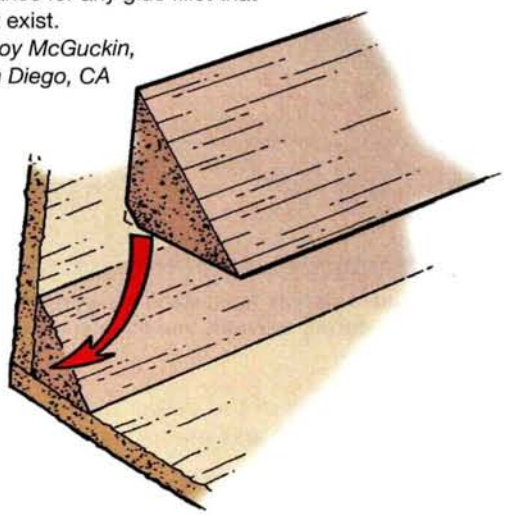
To prevent cowl screws from crushing the balsa, drill a large hole through each side of the cowl. Drill holes through two dowels to make wooden bushings. If you are able to, use a lathe. Finally, glue in the now-suitable-diameter hardwood bushings. The screws can be driven into wooden blocks or into the engine bearers.

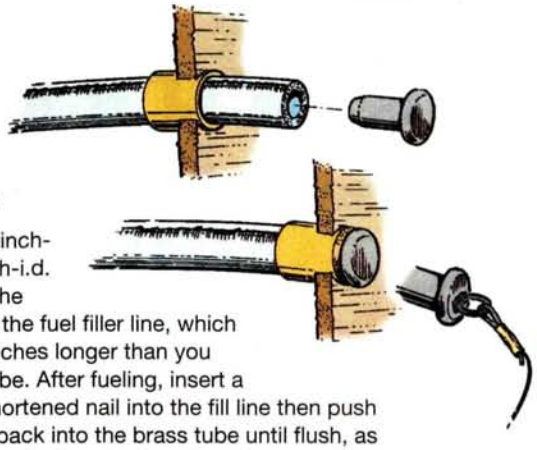
Howard Schmidt, Green Bay, WI

CUTTING CORNERS

For a better fitting corner joint when using triangle stock, sand a little off the 90-degree corner to provide clearance for any glue fillet that might exist.

Roy McGuckin, San Diego, CA

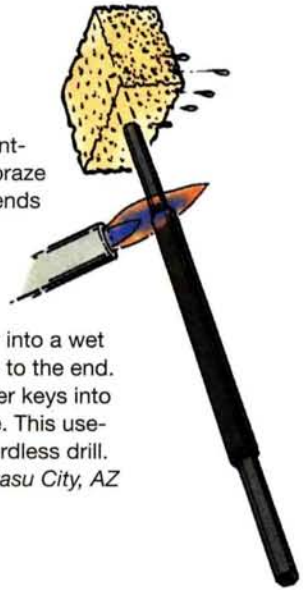




POOR MAN'S DOT

Use CA to glue a 3/8-inch-long piece of 9/32-inch-i.d. brass tube through the fuselage side. Insert the fuel filler line, which should be about 3 inches longer than you need, through the tube. After fueling, insert a plug made from a shortened nail into the fill line then push the fill line and plug back into the brass tube until flush, as shown. Solder a soft wire loop to the nail and secure the plug to the model with a fine wire fishing trace, then paint the nail to match your plane.

Clair Sieverling, Phoenix, AZ



LONG DOUBLE ENDER

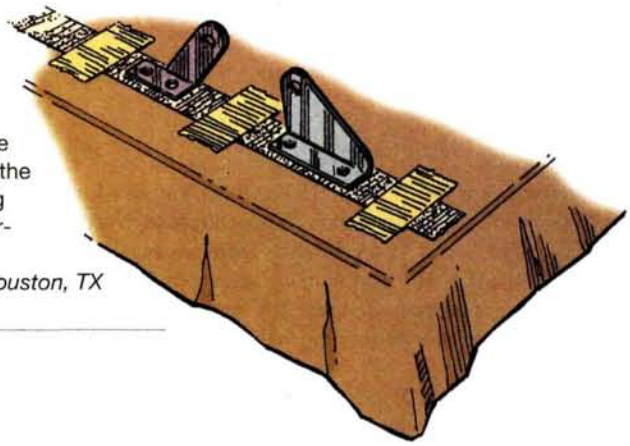
Cut the short leg off different-size Allen wrenches, then braze the longer sections to the ends of short lengths of 1/8-inch music wire. Carefully jig the wire to ensure that the keys are aligned and, while brazing, stick the key into a wet sponge to prevent damage to the end. Some modelers silver-solder keys into a small-diameter steel tube. This useful tool can be used in a cordless drill.

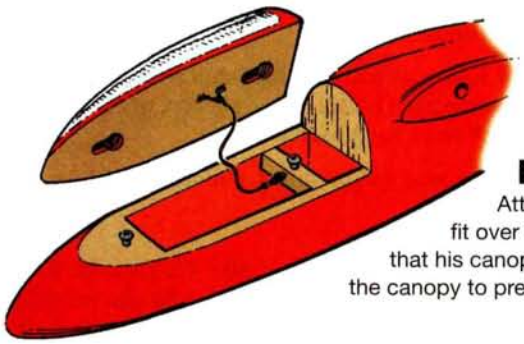
Frank Kelly, Lake Havasu City, AZ

A TACKY JOB

To spray a lot of scale fittings, first attach a length of masking tape sticky side up to your paper-covered bench. Spray the bottom of the fittings and let them dry overnight. Set them firmly on the masking tape strip. This keeps them in place while you spray the upper surfaces and prevents them from falling over while they dry.

Mike DeBlasis, Houston, TX

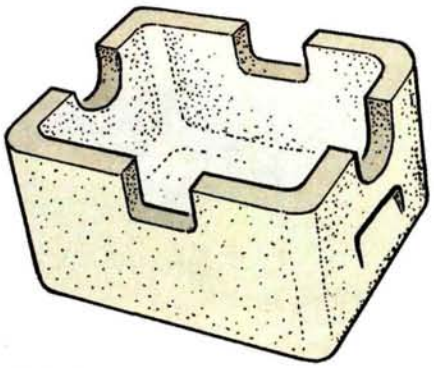




KEYHOLE CANOPY

Attach your glider canopy with keyhole slots in the ply base as shown. The holes fit over two large screw heads, then the canopy is pushed back to lock it. Lloyd says that his canopy has never detached in flight, but you may wish to attach a cord and clip to the canopy to prevent it from blowing away if it's knocked off in a hard landing.

Lloyd Ressler, Gerrards Cross, Buckinghamshire, England



COOL CRADLE

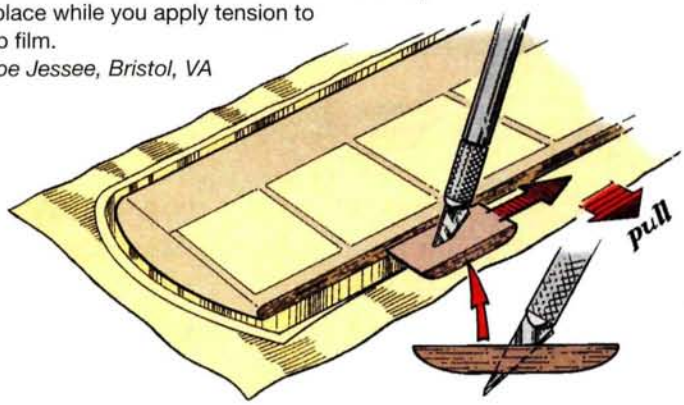
A very inexpensive foam cooler can be cut as shown to make a model cradle for bench or field use. The foam packaging from electronic equipment will also work well. Cut the foam with a hot wire and be sure to sand away the hard foam scab; it could scratch your model's finish.

Chris Archie, Beaumont, TX

CHEAP-O TRIM TOOL

This little, hard balsa "sled" with a glued-in blade produces a consistent flap of covering film around your wings, etc. The position of the blade in the block defines the width of the flap, while the blade point only needs to protrude about an 1/8 inch. Phone books will keep the wing in place while you apply tension to the scrap film.

Joe Jessee, Bristol, VA



MODEL AIRPLANE NEWS
READER'S
GALLERY

T-34 MENTOR

by Bob Hastings

If you follow the more prestigious giant-scale events, you've no doubt seen Mark Frankel's highly acclaimed, ¼-scale T-34 Mentor. This 41-pound warbird has earned first-place static honors in Designer Scale at the WRAM Show and in Toledo. Don't think for a moment that this 99-inch military trainer is some "hangar queen"; the Mentor has been flown and received "Best 2-Stroke" and "Critics' Choice" awards at the Top Gun Invitational in addition to winning several other Nationals-class IMAA meets.

Mark estimates that from research to roll-out, he has invested six to eight months building and meticulously detailing this balsa, foam and ply showpiece (now available as a short kit through Model Specialties*). This Mentor is modeled after a T-34 near Mark's home in Pennsylvania. Having unlimited access to the full-scale is good for incorporating all of the finer details—up to a point; the problem was knowing where to stop. Before he called this project "complete," Mark had incorporated flaps, nav lights, strobes, remote mixture, retracts and a baffled cowl to cool the twin Moki* 3.6, just as in the full-scale's Continental engine. The airplane is topped off with a scale cockpit by Jim Sandquist and a bright yellow PPG automotive finish.

PHOTOS BY BOB HASTINGS, GERRY YARRISH, DEBRA SHARP

SPECIFICATIONS

Model: ¼-scale Beechcraft T-34 Mentor

Designer/builder: Mark Frankel

Type: Korean-era trainer

Wingspan: 99 in.

Weight: 41 lb.

Engine: Moki twin 3.6

Radio: Futaba PCM

Construction: balsa, ply, fiberglass and foam

Finish: PPG automotive paint with Promark* and Aeroloft* markings

Build time: six to eight months

Comments: Mark incorporated flaps, retracts, nav lights, strobes and in-flight mixture into the usual complement of flight controls.

When folks at scale events see hired thumbs like Kerry Sterner and Bob Boswell at the Futaba* controls, the obvious question comes up: why doesn't Mark fly it? Well, he does—when there are fewer critics around. In all modesty, he explains that his building and flying skills aren't quite equal—yet.

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.* ✈

Hangar 9 CHEROKEE

by Craig Trachten

A trustworthy sport-scale ARF

ARFs (almost ready to fly) are certainly one of the fastest-growing classes of model airplane kits, but they have been a touchy subject for many fliers. On the one hand, these kits are flight-ready in just a few hours, and this makes them good for people who have limited recreation time or patience. On the other hand, some modelers doubt the quality of ARF construction. Hangar 9's* new Cherokee should be evidence enough to convince everyone to put their doubts aside and go flying; you cannot build a better, stronger, or less expensive model than this!

PHOTOS BY WALTER SIDAS & GEOFF COZINE

ASSEMBLY

• **Wing.** Start by epoxying in the aileron hinges and the torque rods. Throughout the building of this model, I used epoxy with a longer set time than the instructions called for. Epoxy with a longer set time is thinner and flows more easily; it also allows more time to make adjustments and gives you a stronger bond. Oiling the hinge pivot area will prevent you from accidentally epoxying the hinges stiff. When epoxying the torque rods, use a piece of wax paper behind them as an epoxy guard.

Next come the wing joiners. Spring clamps and/or clothespins will come in handy here. Glue the joiners as stated in the manual. While the wing joiner was drying, I installed an ooze guard—a ¾-inch piece of masking tape around the root of each wing half—because when the wing halves are joined, epoxy ooze is imminent! Simply wipe off the excess, and when all epoxy has dried, remove the tape. By now, the wing joiner should be dry. Mark the centerline as well as the location of the aileron servo, then test-fit each wing half. The joiner should slide into the joiner pocket smoothly without any binding. Sand to fit if necessary.

SPECIFICATIONS

Model name: Piper Cherokee

Manufacturer: Hangar 9

Model type: sport-scale

Length: 45½ in.

Wingspan: 62 in.

Wing area: 620 sq. in.

Weight: 6 lb., 7 oz.

Wing loading: 20.6 oz./sq. ft.

Engine required: .40 to .46 2-stroke; .45 to .56 4-stroke

Engine used: MDS .40 FS-1 Pro

Prop used: Master Airscrew* Scimitar 10x6

Muffler used: optional Pitts-style

No. of channels req'd: 4

Radio used: Futaba 8UAP

Street price: $139.95

Features: realistic scale appearance, 90 percent prebuilt, all hardware supplied, easily accessible radio compartment.

Comments: you couldn't build a kit better than Hangar 9 has built this ARF. Its flight characteristics are excellent, too. You will wonder why you ever questioned ARFs!

Hits
- Well built.
- Great documentation.
- Excellent flight characteristics.

Misses
- None.

FLIGHT PERFORMANCE

When I first arrived at the field, I attached the wing to the fuselage, checked the battery voltage and made sure that all of the control surfaces moved in the right directions. The MDS* engine fired right up, and I tweaked it for peak performance. With that accomplished, I gave the aircraft a trial run up and down the field then took to the air.

• TAKEOFF AND LANDING

The aircraft taxied down the field, attained takeoff speed and climbed out easily. I needed very little rudder to maintain a level climb-out, but once at altitude, a click or two of right aileron and down-elevator was all I needed to attain hands-off, straight and level flight. My second takeoff was not only a surprise to me but also to everyone who was watching. Halfway down the field, the model hit a divot and jumped up 10 or 12 inches off the ground. We all expected the plane to drop, possibly bending or breaking the landing gear. To our amazement, though, it maintained its forward momentum, accelerated and rose into the air.

Landing was as easy as takeoff. This plane is a pussycat. I landed the Cherokee with the throttle two or three clicks above idle. Just before touchdown, I chopped the throttle to idle, and the aircraft just settled to the ground. My second landing was dead-stick. The Cherokee glides and handles like a trainer. The airplane tracked as if it were on a guide wire.

• LOW-SPEED PERFORMANCE

This airplane is not only good-looking, but it is also fun to fly. On low rate, it's as scale as they come. Flying into the wind at low throttle, I had to pull the nose up to stall the aircraft. On stalling, the aircraft mushed nose down without tip-stalling. I added throttle and some up-elevator, and the Cherokee continued on its way.

• HIGH-SPEED PERFORMANCE

Although this is a sport-scale ship, it responds like a sport plane. At high speed, this aircraft showed no bad habits.

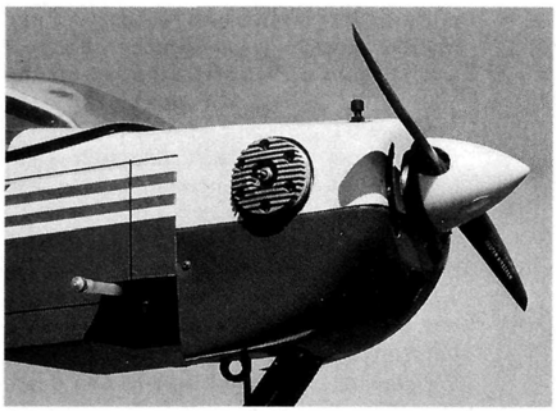
• AEROBATICS

While on high rates, this aircraft is extremely responsive at full throttle. Inverted flight was a piece of cake, but knife-edge flight took full rudder, and the plane still lost some altitude. Rolls to the left were fast and axial; rolls to the right were a little slower and a bit mushy; loops were smooth and round.

When joining the wing halves, don't be chintzy with the epoxy; an in-flight wing failure is not a pretty sight. Brush epoxy onto the spar and into the spar pocket. Join the halves, wipe off the ooze and check the alignment. Tape the wing while it dries, then check your alignment again.

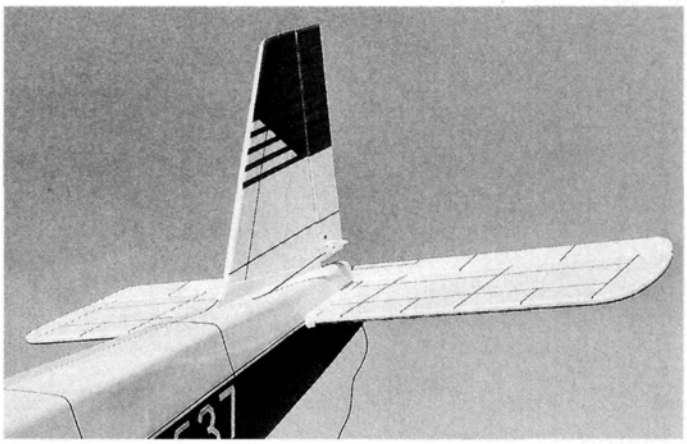
Next, install the aileron servo tray. Cut the slots in your wing and trial-fit the tray supports. Once the fit is correct, glue the tray together. Instead of the recommended epoxy or CA for this step, I used Pacer* ZAP Gel. To fasten the tray to the wing, you should use epoxy. Hangar 9 also includes a piece of trim tape to neatly mask the wing-join seam.

On the fuselage, the holes for the front mounting dowels are predrilled in the bulkhead, so you need only epoxy them in after cutting away the covering over the holes. The rear mounting plate is factory-installed and so are the blind nuts; you need only drill two, ¼-inch, premarked holes. The fit was just a bit too tight on my kit, so I had to make the holes bigger and also remember to make them equal so the wing would be square.



This one-piece cowl is easy to fit and lends a lot to the scale appearance of the Cherokee.

• **Fuselage and empennage**. To install the engine, just align the mount to the firewall and insert and tighten the four mounting screws. The blind nuts are factory-installed in the firewall. Cutting out the five windows takes some time. I attached the first one as instructed, using a sharp no. 11 blade. I scored the plastic until I cut through. Then, using a sanding stick, I finished the opening. Since sanding was necessary anyway, I opted to install the other four windows differently. I drilled a hole and inserted my Dremel* Moto-tool with a ½-inch sanding drum on it, which I then used as a router. (Move it clockwise for internal cuts and counterclockwise for external cuts.) After I was close to the scribe line, I switched to the ¼-inch drum and sanded the rest. I finished off the corners with a sanding stick and eliminated the swirls that the drum created. I found this to be a better method. The front window does not have a scribe line, so you must draw one.



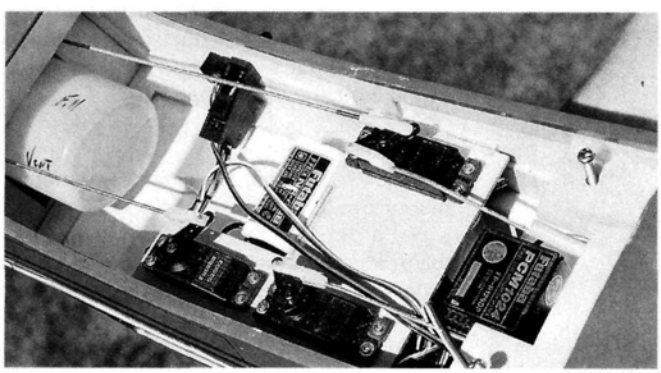
Install the well-covered tail feathers, and you'll be a good portion of the way through the process of building this ARF.

To make the interior fit properly, I had to place it in the cockpit a few times. I thought this might happen, so I waited to install the clear window material until after the interior was in place. Then I used Pacer's canopy glue to hold in the windows and windshield. Last, the servo tray is mounted and the servos are installed.

The tail feathers are quite easy to install. Check the stabilizers' positions, then tape them into place. Install the hinges the same way as you did the ailerons, then attach the control horns.

• **Landing gear**. The Cherokee features hardwood slots for the landing gear. Simply remove the slots' covering, fuelproof them with epoxy and install the gear wires, which are held in place by two straps on each side. The nose wheel is conventional, and the rest of the wheel components are a snap. Hangar 9 has even eliminated the agony of installing wheel pants. The pants are dimpled to match the grill holes and have recesses for the wheel collars as well as for the wheel wire. Not only does this ensure that the pants will be at the same angle, but it also ensures that they will not rotate after installation!

There's plenty of room inside the Cherokee for radio gear, battery and fuel tank.



• **Engine and cowl**. The engine is clamped to the mount without drilling, and this makes minor engine adjustments easy. For the sake of scale appearance, I chose to use the optional Pitts-style muffler (HAN1999). The cowl is also easy to install; just cut away the excess material, and you'll be left with halves that fit together well. I did not follow the recommended assembly instructions, however. Instead, I taped the cowl together from the outside, and when I was satisfied with the fit, I applied medium CA to the seam on the inside. Once the CA was dry, I applied a thin coat of 30-minute epoxy, then covered the seam with a piece of 1-inch fiberglass tape. This method will make the cowl stronger and prevent you from mucking up its nice finish.

• **Servos and pushrods**. I followed the instructions for installing the servos and pushrods to a "T," but I used pushrod keepers instead of Z-bends. I like pushrod keepers because they're easy to install, and they aren't as fragile as Z-bends.

• **Balancing and throws**. The Cherokee balances very easily; the CG can be anywhere from 3¼ to 4 inches behind the leading edge. I balanced mine at 3½ inches. I deviated from the manual for the control-surface throws. The recommended throws given are fine for a standard radio, but since I own a Futaba* 8UAP, I was able to use dual rates. I set the ailerons at 3/8 and 3/16 inch, elevator at ½ and 5/16 inch and rudder at ¾ and 1¼ inches.

CONCLUSION

I like ARFs because I don't have the time to devote to a complete kit. The Hangar 9 Cherokee not only fits into my schedule, but it also meets my standards for materials and quality of construction. You just can't build this aircraft as well and as inexpensively as Hangar 9 does. I give the Cherokee a "10"!

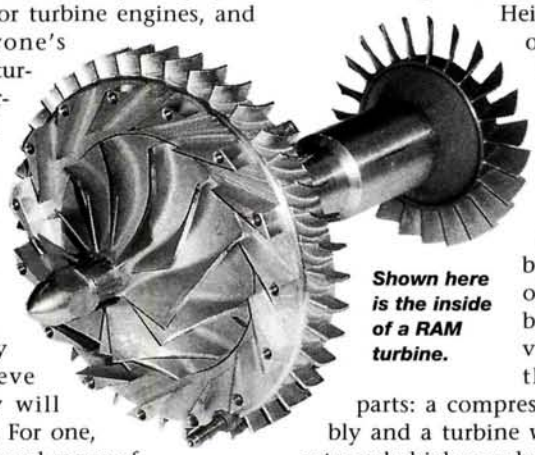
**Addresses are listed alphabetically in the Index of Manufacturers on page 198.* ✈

Spooling Up!

by Rich Uravitch

A closer look at model jet turbines

It's a subject in RC modeling that will stop a conversation instantly. Whether at the flying field, the club meeting, or the neighborhood hobby shop, just mention RC jets or turbine engines, and you'll get everyone's attention. A real turbine engine powering an RC model jet is magical, and everyone seems curious about them.



Shown here is the inside of a RAM turbine.

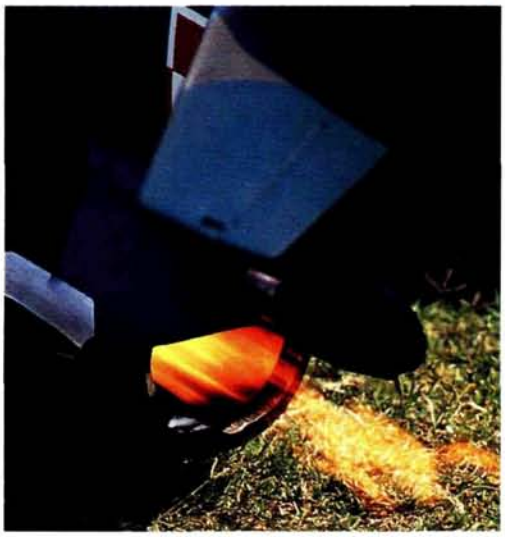
Though turbines may not be for everyone, there are many reasons to believe their popularity will continue to grow. For one, they appeal to a broad range of modelers. Older modelers who have been involved in the hobby for a number of years may see jets as their latest challenge, or they may remember the dawning of the "Jet Age" and want to duplicate their favorite plane. Those RC'ers who are a generation or so younger may see turbines as a logical, high-tech propulsion system for their latest entry into the world of high-speed models. The youngest group of enthusiasts has developed incredible hand/eye coordination with the latest version of "Mortal Kombat," and many see RC jets as a new arena in which to test their abilities. No matter what the age or experience of the modeler, the idea of having a plane that sounds and performs like a real jet is just too good to ignore.

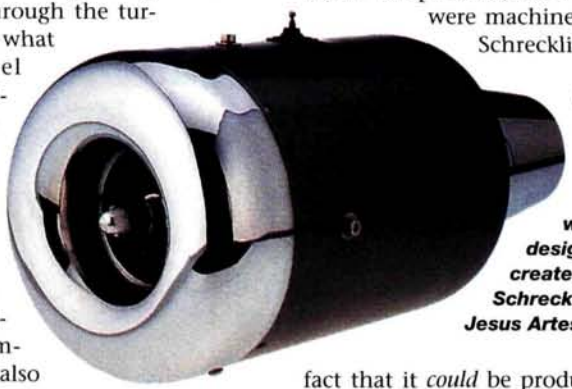
This presentation will provide those modelers who are inexperienced with turbine-powered jets with some information about turbines, clarify some confusing issues and offer comparisons among most of the commercially available turbine systems. It will not be heavily technical in nature because once you are armed with the basics, you can attend any of the growing list of jet events and obtain first-hand any information you may need. I have found that the people involved in jets are really involved and are always more than happy to share their experiences and advice.

TURBINE BASICS

A common misconception about today's RC turbine powerplants is that they are scaled-down versions of present-day, full-size turbines. However, mini-turbines are much more like those simple units that powered the original Lockheed F-80 Shooting Star, Gloster-Whittle E29, Heinkel He-178 and other "first generation" jets.

Simply put, model turbines are just that—simple. Unlike today's medium- and high-bypass turbofans, our model turbines consist of very few (usually three) moving parts: a compressor-blade assembly and a turbine wheel rotating at extremely high speeds on opposite ends of a main shaft and separated by a combustion section. During operation, air is drawn into the front end of the engine by the compressor and is passed into the combustion chamber, where it is compressed and mixed with fuel. This mixture is then ignited, causing the gases to expand and pass through the turbine wheel. This is what makes the wheel rotate. The expanding gases exit the tailpipe and produce the thrust that makes the airplane move forward. Since the turbine wheel is linked to the compressor-blade assembly, the compressor also rotates, and this keeps the whole process going as long as a balance is maintained and fuel is available. An external ignition source is required only for the initial start; after stable operation is established, the entire process is self-sustaining with ignition provided by the repeating process. Also as in a regular RC engine, thrust is varied by changing the amount of fuel that enters the combustion chamber.





Like the Jet Cat and BMT units, the RAM turbines are based on the well-thought-out design of the KJ66, created by Kurt Schreckling and Jesus Artes.

THE ROOTS OF TURBINES

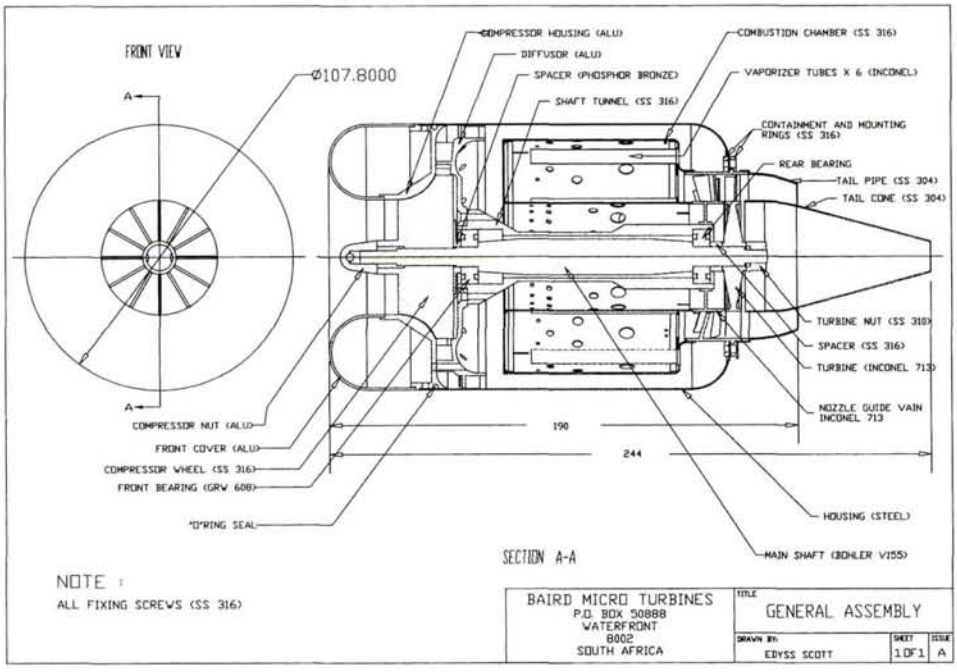
If not for the efforts of a few motivated tinkers, we might still be just thinking about applying turbine propulsion to RC model jets. Germany's Kurt Schreckling is generally regarded as the key player in miniature turbine development. About five years ago, he produced the FD3/64, the predecessor of nearly all of today's commercially available units. This little marvel was indeed "homebuilt," since it was begun more as a hobby project than anything else. Its compressor used wooden blade components; the remaining parts were machined or welded in Schreckling's shop. The fact that it *could* be produced by a hobbyist represented a major breakthrough in itself; it meant that we wouldn't have to wait for a manufacturer with mass-production capabilities. Helping things along considerably were the nearly step-by-step instructions included in the Schreckling book, "Gas Turbine Engines for Model Aircraft." You could feasibly reproduce this engine for less than $200 in materials!

Around the same time as Schreckling, another German, Thomas Kamps, was also busy at work developing his Microturbine. This little gem had about the same general dimensions as the Schreckling FD 3/64 but was a bit heavier. The increased weight, however, was more than offset by its ability to turn significantly higher rpm, which

allowed it to produce nearly 40 percent more thrust. Building time was reduced considerably through the use of a commercially available turbocharger compressor. Kamps' book, "Model Jet Engines," is very informative and, like Schreckling's, takes you through the construction and offers important formulas for predicting performance and limits.

The second-generation turbine, and the one on which nearly all the current production offerings are based, is the KJ66. The "K" stands for Kurt (Schreckling) and the "J" is for Schreckling's co-developer, Jesus Artes. This design was so

Today's model turbines, such as this BMT unit, use electronics to control a range of features, from starting the engine to monitoring rpm, exhaust temperature, etc.; if a problem is detected, some of these onboard controls will even shut the turbine down.



Shown here is a schematic diagram of a BMT turbine. Although it seems complicated, when viewed in this manner, a turbine is actually fairly simple.

well thought out that it went on to form the basis of the RAM*, SimJet*, Jet Cat* and BMT* units.

DESIGN AND OPERATION

The design of these turbines is relatively simple and uncomplicated. They have fewer moving parts than a 4-stroke engine, so they are fairly easy to operate—especially the newer versions. The key to

A BLAST FROM THE PAST

Think everything in the model turbine world happened in the last 10 years? Well, get ready to flash back to the early '60s. I recall seeing an ad in the magazines for a "turbojet" engine that looked just like the real thing: the Turbocraft U-22.

The U-22 probably didn't cause much of a stir among modelers. Remember, this was in 1963, when $189.95 could buy an awful lot of silk, dope, K&B engines and Berkeley kits, as opposed to one turbine with no track record. If you bought one of these engines, it was something for which you "saved up."

It was a fairly sophisticated piece of machinery for its time (these were the days before computer applications that would enable CAD, CAM and CNC processes). I have a copy of the technical manual that accompanied the unit, and it contains some interesting information. For example, it was 12 inches long with a 2.75-inch diameter and weighed a mere 22 ounces while producing eight pounds of static thrust. White gas (AVGAS) or alcohol was the recommended fuel, but "methyl or ethyl alcohol" could be used; in fact, the manual added, "Menthol or other chemical coolants can be mixed with the alcohol to produce very satisfactory results." It was also claimed that "The U-22 engine can be throttled to perfection ... by placing a [servo-actuated] needle valve between the fuel tank and the engine." So much for the passage of nearly 40 years and the computer chip-laden ECU!

Seeing this turbine also leads one to conclude that our society was far less litigious back then. Turbocraft and most other companies didn't live under the specter of product liability lawsuits; this becomes fairly obvious on reading the instruction manual. It notes that the engine came supplied with an *afterburner* fuel inlet port, which could provide an additional 2 to 4 pounds of thrust! Pressurized fuel was introduced by yet another servo-controlled valve. "Dynamic airplane performance during takeoff can be realized using afterburner systems," the manual states. This is true, but probably not on this engine! Fortunately, I don't think the Turbocraft U-22 ever actually flew an RC model airplane because it seems that would have been a considerable mistake. If anyone has information to the contrary, I'd love to hear about it.

The U-22, like other products we have all discovered, is probably better to read about than to actually use. Exciting idea, skilled manufacturing ... who knows what could have happened?

their ease of operation is the computer chip. Early model turbines metered fuel intake with mechanical systems that, while fairly simple, often left a bit to be desired in terms of accuracy and reliability. The electronic control unit (ECU) is the heart of the modern model turbine. Once you teach it to "talk" to the throttle stick position of your RC system, the ECU does an incredible job of keeping the turbine going or, if necessary, shutting it down. It initiates and controls the start sequence and uses sensors to constantly monitor the exhaust gas temperature (EGT) as well as the compressor pressure and/or rpm. If it detects a problem, it instantly shuts down the engine by terminating the fuel flow.

One of the nicer features of a turbine is that it is incredibly user-friendly. There are no needle valves to adjust, so you're not going to be frying plugs, bending rods, or worse, as is sometimes the case when operating high-revving, ducted-fan engines or in-flight mixture devices. Once the turbine is running, its performance is usually uneventful and trouble-free—qualities you will appreciate.

The JPX propane-burning turbines were the first to be accepted by the AMA. The new JPX turbines operate on standard fuel and use propane only for startup.

You need only a couple of things to start any of these model turbines. The first is an air source to spin the compressor wheel up to the rpm required to support the ignition sequence. This is why you see those garden blowers at jet meets. They're also used to help purge the turbine and airframe ducting of vapors as well as to cool things off after shutdown. These blowers can also be used to "police" the startup area to reduce foreign object damage (FOD). Scuba tanks are also frequently used as an air source.

The second thing you need to start a turbine is propane gas (LP). Although the early version of the JPX* turbine ran completely on propane, this gas is used almost exclusively for startup, after which the engine is fed by standard fuel—purified-grade (K1) kerosene, JET A fuel, or a mixture of the two. For lubrication, most of the turbines use jet-engine oil; typically, Aeroshell 500 or Exxon 2380 mixed in with the kerosene at about a 5-percent ratio (1 quart per 5 gallons of fuel). Some, like the Sophia* J-850 and the Cobra*, use what is referred to as a "total loss" system wherein the oil is carried in a separate tank and introduced to the engine bear-

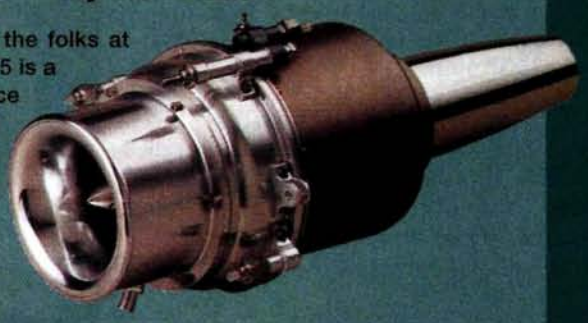
Sophia turbines use a "total loss" system for lubrication. In this system, the oil is stored in a separate tank, and it lubricates the bearings by means of a pump or pressurized system.

The Jet Cat Hammer includes an onboard propane tank for startup and an electronic start unit that is also capable of cooling the turbine after a run.

ACE HOBBY/THUNDER TIGER USA P-15 MICRO TURBOJET

by Geoff Cozine

It has been years in the making, but the wait is almost over: according to the folks at Thunder Tiger*, the P-15 Micro Turbojet is nearly ready for production. The P-15 is a joint effort between Thunder Tiger USA and the Center for Aviation and Space Technology, an industrial-technology research department of the Taiwanese government. At 12.6 inches long with a diameter of 4.567 inches, this engine will weigh about four pounds and is said to be able to produce a maximum of 12 pounds of thrust while burning a mixture of kerosene and gasoline. Be on the lookout for this latest addition to the turbine world. No definite release date has been given, but I am told that one will be set soon.



Like some other companies' turbines, the Jet Cat Hammer's ECU is also capable of logging much of the information needed for maintenance.

ings by a pump or pressurized system. Both systems are effective; each has its advantages and disadvantages.

Once you have fuel and air, all you'll need is a battery to light the plug for the initial startup. After getting a signal from your receiver, the ECU takes over and relinquishes throttle command only after it has made certain everything is operating properly. It's that easy. What makes it even easier is that recent developments have allowed the incorporation, on most engines, of full "auto-start" capabilities. The Golden West Models* Jet Cat Hammer is a state-of-the-art system that includes a small, onboard propane tank for the initial ignition as well as an engine-mounted electric start unit that also cycles on and off after shutdown to cool the engine.

THE COST OF RUNNING TURBINES

Before discussing the costs of turbine-powered modeling, it is important to understand that there is simply no better way to create real jet flight. The sound a turbine produces when it's whirling around at more than 100K rpm and with contained explosions ... well ... it just doesn't get any better than that.

Kerosene costs significantly less than glow fuel, but a turbine uses about nine ounces per minute at maximum power, so the costs even out. You're not going (nor is it advised) to perform much internal maintenance, either. At specified intervals based on operating time, you'll ground your airplane, remove the entire propulsion system and ship it all back to the factory or service center.

Just like their full-scale cousins, miniature turbines require scheduled maintenance and inspections if you want to avoid problems with potentially catastrophic results. This will require that you keep accurate logs of your turbine's life. The ECUs of some of the systems even help you with this. To keep the engine alive, well and operating correctly between trips to the factory, the "statistic" menu of the Jet Cat Hammer logs valuable information such as "total run time," "aborted runs," "starts failed" and "ignitions OK."

It's a given that turbines represent cutting-edge technology that is simple, reliable and just plain cool, but let's get to the bottom line. Hold on to your plastic;

The AMT Mercury, Pegasus and Olympus offer a wide range of sizes and power levels so you can more accurately match a turbine to your model.

TURBINE SPECIFICATIONS

COMPANY	PRODUCT	LENGTH (in.)	DIAMETER (in.)	WEIGHT (lb. dry)	WEIGHT (lb. installed)	THRUST (max.)	THRUST (min.)	FUEL consumption (oz./min.)	PRICE (system)
AMT	Mercury	8.9	3.9	3.1	4.3	15.7	0.7	7	$2,695
	Pegasus	10.6	4.7	4.6	5.7	22.5	1.1	10	$4,295
	Olympus	10.6	5.1	5.3	6.5	42.5	1.5	14	$5,295
BMT	BMT80	9.64	4.25	2.5	3.4	18	1.0	9	$2,195
GWM	Jet Cat Hammer	11.8	4.4	2.8	4.0	17.0	<1.0	8.1	$3,395
JPX	T-260K	11.61	4.56	2.7	3.9	13.2	0.9	6.5	$2,995
RAM	750F	9.5	4.25	2.5	3.7	17	1.0	9	$2,995
SIMJET	1200	9.45	4.25	2.52	2.98	12.0	0.8	5.43	$2,500
	1750	9.45	4.25	2.52	2.98	17.5	0.8	5.80	$2,500
	2250	9.45	4.25	2.52	2.98	22.5	0.8	6.73	$2,500
SOPHIA	J850	13.0	4.25	2.6	3.08	18.7	1.0	3.5	$2,395

ENGINES ACCEPTED BY THE AMA

ENGINE	MODEL	CONTROLLER	DATE ACCEPTED
JPX	T240/250/260 (propane)	None; manual valves only	02/16/96
Golden West	FD 3/67	Golden West ECU and ground-control unit (GCU)	12/30/96
Turbomin	TN 100	Turbomin TN100[1]	01/07/97
Turbomin	TN 60	Turbomin TN60[1]	01/07/97
AMT	Pegasus MK-3	AMT Pegasus ECU	02/05/97
Sophia	J450	Sophia FET	02/11/97
RAM	500	RAM 500 ECU	09/19/97
RAM	750	RAM 750 ECU	09/19/97
AMT	Mercury	AMT Mercury ECU	02/17/98
Sophia	J450P	CAI ECU	07/21/98
Sophia	J450	CAI ECU	08/21/98
Sophia	J450S	Jet Tronic (German)	10/02/98
Sophia	J850	Jet Tronic (German)	10/02/98
JPX	T260K	JPX ECU	10/02/98
AMT	Olympus	AMT ECU	01/29/99
Golden West	Hammer	Jet Tronic ECU	01/29/99
RAM	750F	RAM 750F ECU	03/02/99
RAM	1000F	RAM 1000F ECU	03/02/99

[1]Computer-operated control system

the price for a complete new system today runs between $2,000 and $4,500, with AMT* topping the charts at $5,500 for its monster, Olympus. You may pay a lot, but the Olympus will whip out a whopping 42.5 pounds of thrust! For those of you who have the time and motivation to offset your lack of funding, companies such as Phoenix* also offer engine kits in various states of assembly. This saves a bit of money and provides you with the opportunity to study the inside of your engine. For you bargain hunters, early versions of units such as the propane-fired JPX T-240P can be found used for as little as $1,200.

Turbines may be expensive, but the technology and sophistication you get when you purchase one make it a bargain. If you do buy one, accept the fact that there will be recurring costs involved in maintaining and servicing your engine, although you get a lot of operating time in between. Don't be tempted to ignore needed maintenance for "just one more week," though; for safety reasons, it must be done.

Safety also finds its way into the other investment you'll make: time. You will need to spend some time learning about turbines. Then, you will need to prove to the AMA that you really understand the system you're planning to operate, and you will need to answer 10 questions concerning turbines, such as "Explain the effect of throttle lag and residual thrust on landing approach, go-around and ground landing," or "Explain fueling and startup procedures in terms of pit crew, crowd control and distance, wind direction, etc." You'll also certify, in writing, that you "... have successfully completed a minimum of 50 flights with a high-speed RC model aircraft designed to fly 150mph or better." I suppose if you cruise around at 70mph with a typical, moderate-performance ducted-fan model, you meet the letter of the law. Your model may have been *designed* for 150mph; you've just never flown it beyond 70. If you stretch the rule, it's your own investment you're risking.

MATCHING YOUR AIRFRAME TO A TURBINE

You're probably wondering if you'll need a special airframe to house a turbine. This is not a concern because most of the available turbine kits are around 4.25 to 4.50 inches in diameter, and most of the existing ducted-fan airframes are designed to accept 5.25-inch fan units. If there's a space for your turbine in a model, a turbine should work fine. Unlike ducted-fan propulsion units, which can benefit tremendously from a well-designed inlet, these simple turbines are much more tolerant of bad—or even no—inlet ducting. Turbines produce their own thrust, whereas the ducted fans produce thrust by accelerating incoming air and discharging it.

The more smoothly air can get into your engine, the faster it can exit, and this will produce more thrust. Although I have seen turbines work successfully when bolted into a model, you should use that extra space for a good inlet and bypass cooling duct to increase performance. You will be carrying more fuel and accessories on board, but finding room doesn't seem to be a problem in the airframes I've seen converted from ducted fans, and the all-up flying weight is usually only slightly heavier.

SO WHAT'S NEXT?

We're likely to see more tailored accessories, even more simplified operation and, I suspect, the same prices for a while. I don't expect to see a lot of the current-day units on the used market, either. Today's turbines are about as sophisticated as they need to be; they deliver solid, reliable performance with a minimum of fuss. I suspect that software changes that allow the user to "turn up the wick" for additional thrust are a possibility; in fact, much of that is available now. There will always be guys who experiment just for the satisfaction of meeting a challenge. I even heard that there's a guy out there who's working on a turbo-prop! His name? Kurt Schreckling!

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.* ✈

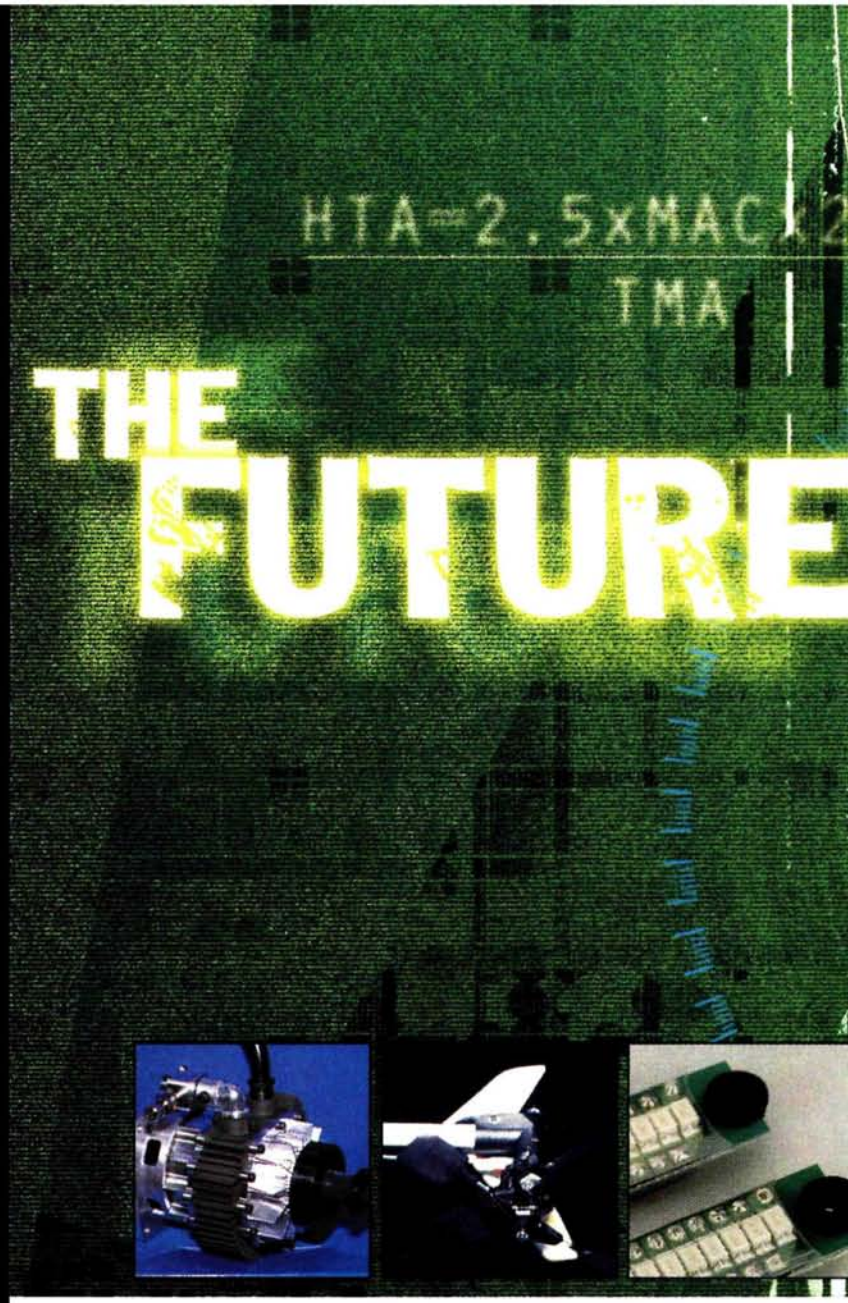
By Model Airplane News *Staff, Bob Aberle and Dave Gierke*

Over the last century, basic aircraft design and aerodynamic theory have been relatively constant: an airplane needs a lifting surface (a wing), control surfaces and a power source. Newer construction materials, such as carbon fiber, fiberglass and closed-bead foam, have affected RC model design and construction, but the capabilities of the radio and power systems are the driving force behind modeling innovation and growth. Today's models push the flight envelope in every possible direction: we fly giant, gas-powered, ½-scale aerobatic aircraft and tiny electric micro indoor flyers that use infrared radio systems; unlimited racers can reach speeds of more than 240mph, while slow backyard flyers can maintain controlled walking speed; scale craftsman detail models to become exact replicas of the originals, and NASA aerodynamicists use models to test concepts for full-scale craft. In the midst of these extremes, modelers have been building airplanes for the last 100 years by cutting and gluing balsa, and we anticipate that modelers will be doing the same for the next 100 years. Even while new technologies expand our possibilities for innovation, modelers have continued to embrace craftsmanship and building skill. Will balsa ever be replaced by a synthetic alternative? Perhaps, but we anticipate more likely improvements to our hobby.

We look forward to covering materials that are even easier to apply; more user-friendly, convenient adhesives that won't glue us to our models; inexpensive, turnkey trainer, sport and scale craft; new, less expensive power sources and fuels; smaller, more affordable turbine engines; virtual reality flight simulators in our homes; and hand-held lasers that cut balsa wood but not fingers!

Will model airplanes ever be independent of their pilots? Roy Clough notes, "I wrote in 1947 that model planes will eventually become 'robots,' independently capable of responding to their environment, but responsive to their operator's wishes. This, of course, implied some sort of autonomous onboard logic. Fifty years later, the forerunners of the future have arrived in the form of gyros and horizon-sensing adjuncts that control attitude and heading with no input from the operator. Much more sophisticated things are to come."

On the first free-flight airplanes, we trimmed our models, started their engines, launched them and hoped they would return—or at least, hoped that we could see where they landed! In the next century, will we come full circle to program our models, start the engines and launch them, only to stand back and watch them perform on their own? Only time will tell.



How long will it be before our transmitters look like this? Besides all the bells and whistles, we could have mini-CD programmability and GPS fail-safe auto-landing features. Wouldn't that be cool?

THE FUTURE OF RADIOS AND ELECTRONICS *by Bob Aberle*

There is a belief among aerospace engineers and marketing mavens that it takes 20 years or more to develop a new air- or spacecraft, yet it may take only five years to bring new electronics equipment or systems to maturity. If that comparison is true, we should have in store for us much progress in the electronics field during the new millennium's beginning. We hope to see and enjoy a lot of that progress during our lifetimes.

With those thoughts in mind, let's take a little excursion through some of the areas in which progress will (or should) be made. This is my personal "wishbook" for the future in model aircraft electronics and electric power.

RC SYSTEMS

We are lucky to now have 50 RC channels on 72MHz dedicated by the FCC to the flying of model aircraft. Although we once thought that other services might try to use our channels, it was our good luck that cell-phone technology came along. Today, all of this tremendous new communication activity is up in the 900MHz region, leaving us pretty much by ourselves. The downside to this is that the technology being constantly improved up at 900MHz isn't going to help us as much way down on 72MHz. So I do look forward to future new RC channel allocations, possibly higher up in the radio spectrum, that may benefit us more. The mode of operation known as "spread spectrum" has been talked about for some time. To make that technology work for us, we will likely need a new band of frequencies. But I do see in the future something like spread spectrum, or possibly some other new form of digital coding transmission, either of which could virtually eliminate all forms of potential radio interference.

TRANSMITTERS

With sufficient memory and easier up- and downloading, personal computers will enable future modelers to own only one good-quality transmitter. As I write

RC ACHIEVEMENTS TO LOOK FOR IN THE NEXT MILLENNIUM

- Truly glitch-free radio technology.
- Indoor flying facilities for all sizes of models.
- Interchangeable transmitter parts (switches, knobs, etc.).
- Mechanical feedback control "feel" at the sticks.
- Inexpensive downlink telemetry.
- Lighter, longer lasting battery packs.
- Servos that sense control-surface loads.
- True autopilot capability.
- Virtual-reality plug-ins for transmitters.
- New RC aircraft for flying in zero gravity (space stations).
- Synthetic "muscle control" to eliminate servos.
- Voice-activated RC.
- Verbal transmitter alarm systems.
- GPS-control fail-safes (will safely land your model when signal is lost).

this in late 1999, I'm looking at six of my personal transmitters, all hooked up to various trickle chargers. In the future, I hope one really good, simple-to-operate transmitter will replace them.

To make things happen without the usual accidents, I look forward to voice alarm systems that tell you which memory position is currently set in the transmitter. For example, when you turn on your transmitter to get ready to fly, a voice will tell you, "Aeronca L-3 scale electric." In the same regard, I foresee built-in channel synthesizers that will allow you to dial up all 50 RC aircraft channels without needing to change a module or crystal. Again, I would like that same voice alarm to tell you the channel number that you are set to transmit on. To prevent accidentally using someone else's channel, the alarm should sound when the transmitter case is first touched, similar to the way a motion detector works. Why? Because after the power has been turned on, the damage could already be done.

I suspect the transmitter's control capabilities will keep improving along with the development of new microchips. I do hope, though, that the circuit designers will strive for the easiest operating menu systems. If we are all going to have sophisticated transmitters, then let's make sure that everyone can operate them. How about a large LCD screen on the rear of the transmitter case? This would display various help menus and would be much like having a set of instructions with you all the time.

RECEIVERS

Again, we look forward to the benefits of newly developed integrated circuits that will constantly improve the performance of our receivers. Although we have made tremendous strides in the past 20 years, improvements are still needed in both selectivity (coping with adjacent channels) and sensitivity (radio range). While improving range, we should also concentrate on being able to shorten the antenna length, making model installations more convenient. We probably should also be using a truly universal type of connector and connector blocks that will permit all kinds of interchangeability. These connectors should be foolproof, so that you can never reverse polarity and blow anything out.

If we are considering a built-in channel synthesizer at the transmitter end, then we should be thinking of some form of synthesizer at the receiver end. This way, you could quickly pick an open channel at your flying field, set your transmitter to that channel and then do the same on the receiving end. The method of doing this should be both quick and safe.

SERVOS

Let's get out of our present rut and come up with some new designs for our proportional servo actuators. The same style with a rotary output has been employed for the past 30 years and more. Let's try linear output servos again, and let's have servos with a flat configuration to allow easier mounting in a model. Perhaps we can develop better linkage connections between the servo and the control surfaces. The new digital servos offer some high-resolution possibilities; that's certainly a step in the right direction.

BATTERIES

Things are gradually improving in the world of RC system batteries. The new NiMH cells can provide as much as 1400mAh capacity in the same size package as the 500mAh packs we used previously. This provides longer operating times without the need for field charging. Developments in the electric power field in the future will obviously spin off to RC system batteries as well.

MICRO RC

This is now coming into its own. New RC manufacturers have paved the way and created an entirely new marketplace by producing tiny or micro-size RC receivers, servos, motor speed controls and the like. The goal of all this is to be able to fly RC model aircraft indoors—especially desirable during winter months or inclement weather. These same, small RC systems can also benefit the new, small models being flown outdoors in parking lots and schoolyards.

The microflight movement is becoming so large that the publishers of *Model Airplane News* have recently committed to the publication of "RC Microflight," a new newsletter showcased in this issue.

ELECTRIC-POWERED FLIGHT

During the past 20 years or more, electric power has been on the rise within the ranks of model aviation. Basic ferrite motor technology has been expanded into cobalt magnet motors and brushless DC motor technology. Each new type offers better efficiency than its predecessor. Our battery technology has also constantly improved. And, we have more efficient motor drive trains that substitute belt- and gear-reduction drive for the time-honored direct drive. The result is larger props that develop more thrust but turn at lower speeds and with less current drain. The bottom line is that we are now able to fly larger models for longer periods of time, but we have still only seen the tip of the iceberg.

The new millennium will undoubtedly bring us a new world of practical electric-powered automobiles. From that improved technology will likely come spinoffs that will benefit electric-powered flight. Who knows? We might even see a miniaturized fuel cell developed to generate electric power from fuel or gas expressly for model airplane use. We may also see improved electronics that allow us to use AC motors. Electric-powered flight is still in its early stages; as we continue to pursue this form of power, it can only get better.

SUMMARY

There is much we can and hope to do in the next millennium to advance our wonderful hobby. We need to bolster the enthusiasm of our young people so that our ranks continue to be filled by the younger generation. Computers, Internet activities and simulators will all help; but the bottom line is that you must still take all of that technology and go flying. That's what it was always about, and that's what it will continue to be about in the next century.

POWER FOR THE 21ST CENTURY *by Dave Gierke*

Tracing the development of model airplane engines through the 20th century (see the December '99 *Model Airplane News*) was fun and enlightening, but the next question is, "What does the 21st century have in store?"

Although cumulative design experience helped improve engine performance after 1932, the exponential growth of scientific and technological knowledge during this period played a much larger role.

For the last 70 years, the motorcycle industry has offered the biggest bang for the research buck in terms of improved piston engines, but circumstances changed in the last decade. The U.S. military has found exciting new applications for prime movers of all types and sizes, while government agencies continue to provide millions for their advancement. Now, however, these same agencies demand technology transfer strategies, detailing how new developments can be used by the commercial sector. The world of model aviation will eventually benefit from all of this.

Because I'm not one to gaze into a crystal ball, the best I can offer is an extrapolation of current research and development, which may provide insight into model aviation's power and propulsion future.

Unmanned aerial vehicles (UAVs) are hot topics for military strategists, thus providing American universities, think tanks, large corporations, small businesses and individuals with a new crusade.

BRAYTON CYCLE PISTON ENGINE

Imagine a piston engine with less than ⅔ the displacement of a Cox .010 that operates for more than an hour on a 1-gram (1/28-ounce) solid pellet of fuel! With a power level of only 1 watt (0.0013hp), this tiny, external combustion engine is capable of flying a micro air vehicle (MAV) at 20mph for over an hour. Total weight of the engine and fuel: ¼ ounce (7 grams).

The engine and system are the brainchild of Franklin Vassallo, our own "Professor Physics" of "Real Performance Measurement" fame and engineering consultant for Veritay Technology Inc. This powerplant is a candidate to power a military MAV sometime in the next decade.

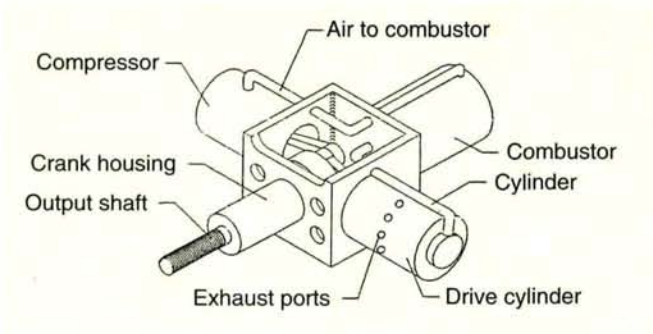
In the Brayton cycle, air is compressed, heated to a moderate temperature (1,540° F) and then expanded in a manner that provides useful work. These processes are executed continuously in a turbine system; however, this micro-engine uses reciprocating pistons. Some design features include horizontally opposed compressor and drive cylinders, integral combustion chamber, carbon-based fuel and lapped graphite compressor and drive pistons.

With the drive cylinder inlet pressure set at 100psi and the exhaust pressure at only 20, the engine produces little noise. Simplicity and extended shelf life were also considerations, i.e., no carburetor or sustaining ignition systems are required; a pyrotechnic igniter is used to initiate pellet combustion. Although this engine could have several applications in model aviation, it seems ideally suited to indoor micro RC models, where light weight and extended operation are difficult parameters for present-day energy converters to satisfy.

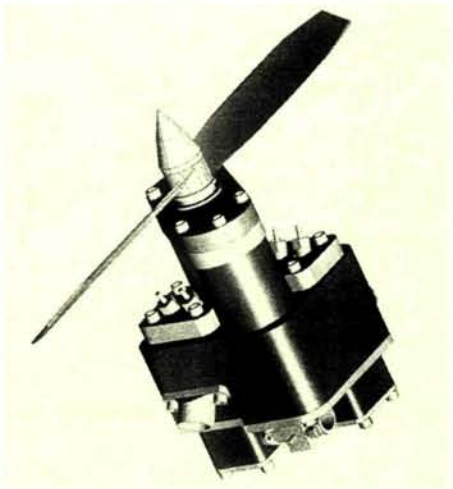
EFFICIENCY

For more than 150 years, engineers have known how to produce more efficient combustion engines, but they lacked the enabling technology. At the beginning of the 21st century, these engines still aren't very efficient. All convert less than half the fuel's energy into useful work, and most do much worse! Higher efficiency requires higher operating temperatures—the higher the better. High temperatures are linked to higher pressures and greater torque at the crankshaft, or thrust at the exit nozzle, as defined by science's gas laws. Such matters fall within the domain of thermodynamics—a subject most students wish they could avoid.

In part, temperature limitations depend on engine construction materials. Operated fuel-lean for a prolonged period, the engine's aluminum alloy piston might begin to melt. Excessively high compression ratios can produce similar results. Both conditions can trigger pre-ignition or detonation—combustion defects that can be very destructive mechanically.



The Brayton piston engine. It is only 1½ inches long and 1 inch wide, and it weighs less than ¼ ounce with fuel.



Veritay Technology's horizontal 2-stroke piston engine will be small enough to fit into a 5-inch gun barrel and will withstand 15,000G of acceleration.

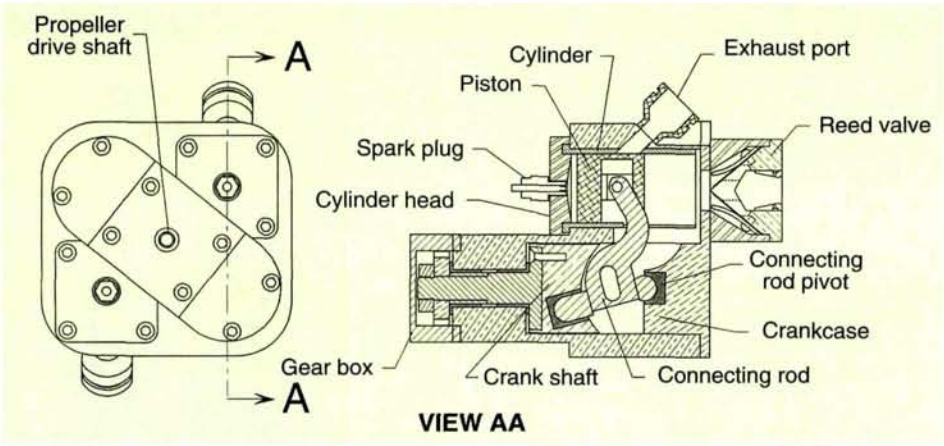
IMPROVED MATERIALS

COMPOSITES

- **Plastics** (including epoxies), carbon fiber, glass fiber and other combinations can be considered for relatively low-temperature applications such as backplates and front housings.
- **Carbon-carbon composite** is a space-age technology in which carbon fibers are integrated in a carbon-fired matrix. Fabricated components are extremely light weight, have high tensile strength and withstand extremely high temperatures. Carbon-carbon exhibits poor oxidation resistance, and this probably eliminates it from being used in the combustion zone. By arranging the direction of

OTHER RESEARCH

- Micro silicon carbide gas turbine (3 million rpm; 10mm in diameter; 3mm long; weighs 1 gram; M.I.T. Lincoln Laboratory).
- Micro rocket (M.I.T. Lincoln Laboratory).
- Micro pulse jet (Georgia Tech, Research Institute).
- Reciprocating Chemical Muscles (chemically injected reaction chamber generates gas for mechanical ornithopter; Georgia Tech).
- Steam engines (open cycle, catalytic burner, flash boiler).
- Sterling-electric hybrid.



A cross-section of Veritay Technology's horizontal 2-stroke piston engine.

the fibers, thermal conductivity can be enhanced to that of elemental carbon, which makes the material a very good candidate for crankcases.

CERAMICS

• **Aluminum oxide** can be used as hard-anodized plating (pistons, cylinders, backplate faces).

• **Silicon nitride and silicon carbide** are cast, lightweight material for high-temperature, high-strength applications. About the same weight as aluminum, these materials won't melt at three times the temperature at which most aluminum alloys will, and they possess twice the strength of the aluminum alloys. They also exhibit high thermal conductivity, low thermal-expansion rates and are oxidation-resistant. Although difficult to work with, both materials have been used for gun barrels and automotive turbocharger applications. Crankcases, cylinder heads, cylinders and pistons are likely candidates for this promising technology.

METAL MATRIX BLENDS

• **Mixtures of metals and ceramics** also offer promising new materials for engine designers. Low oxidation rates and good impact resistance are combined with good high-temperature performance, although they are limited by the metal portion of the mixture. Potential engine applications include cylinders and cylinder heads.

Improved materials for engine construction represent a large part of the efficiency puzzle; however, special high-temperature ignition-point fuels will be needed to avoid the combustion defects identified earlier. Unfortunately, fuels such as JP-8 also have low volatility, which necessitates the development of a cold start-up system.

Today's lubricants break down at temperatures less than 600° F—much too low for the high-temperature applications we have been discussing.

HORIZONTAL PISTON ENGINE

The Navy needs a 2hp engine that's small enough to fit into a 5-inch gun barrel and withstand 15,000G of setback acceleration. It must run on JP-5 (jet fuel) and be capable of supplying 100 watts of electrical power to operate equipment on board a UAV. The engine must self-start after its ballistic trajectory launch and use less than a quart of fuel per hour at 70 percent power.

To fit into the gun barrel, Veritay Technology engineers decided that the 2-stroke engine needed a piston that would move horizontally and parallel to the crankshaft instead of the conventional configuration. Although its operation is proprietary, engine components for a twin-cylinder "cluster" can be seen in the included figures. Each cluster consists of two, single-cylinder laid forward units mounted adjacent to each other. The two crankshafts are linked by a gearbox, which also provides a degree of speed reduction for increased torque output and reduced propeller noise. Axial vibrations are reduced to a minimum by using alternately firing cylinders.

If power output needs to be increased, individual clusters can easily be linked in tandem by extending the propeller/auxiliary shaft to meet most flight program goals without designing a new engine. The auxiliary shaft is also used to drive an electric starter/generator and a mechanical circulation pump for the coolant. Fuel requirements and the engine's pusher configuration dictated the use of liquid cooling; JP fuels offer little cooling effect when vaporized (much like gasoline), and ducting for air cooling proved to be complex and inefficient. By directing the fuel reserve through coolant channels in the crankcase and head, a separate reservoir for conventional coolant was eliminated while the low volatility fuel was preheated before entering the carburetor.

The horizontal piston engine offers advantages that may be attractive to the RC community: small frontal area, high power-to-space ratio, power multiplication versatility, extremely low axial and radial vibration levels, multi-fuel capability, glow or spark ignition option, moderately low rpm, high torque and low exhaust and propeller noise levels.

FUEL CELLS

For electric motor operation, the fuel cell offers hope for a lightweight, high-energy density alternative to the chemical battery. The fuel cell converts chemical energy directly into electricity without combustion as an intermediate step. Fuel cells are similar to batteries in that they both produce DC current by means of an electrochemical process. Fuel cells are different from batteries because they store their reactants (hydrogen and oxygen) externally and operate continuously, as long as they are supplied with fuel.

Fuel cells are combined into groups called "stacks" to achieve useful voltages and power output. As with all developing technologies, there are a number of unresolved critical issues such as weight and fuel conditioning, but this is one to watch. +

Author's note: special thanks to Frank Vassallo—my partner in aeronautical investigation—for his valuable assistance in the preparation of this article.

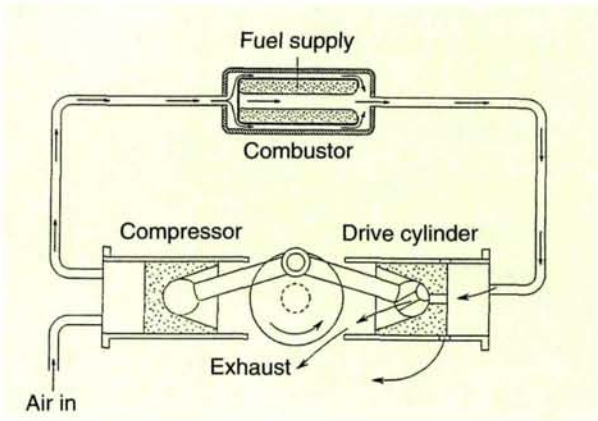


Illustration of Open Brayton Cycle using reciprocating pistons.

by Jerry Nelson

CHICAGOLAND

THE CHICAGOLAND FESTIVAL of Giants is one of the largest IMAA fly-ins in the Midwest. From July 16 through 18, 1999, the event was held at the Fox Valley Aero Club's flying field about 30 miles west of Chicago in St. Charles, IL. Modelers came from all over the country, including Florida, Delaware, Wyoming, Texas and Oregon. The flying site is outstanding: a 50x500-foot paved runway with grass overruns at each end, no obstructions for taking off and landing, and the over-fly area is unlimited flat land. The large grassy area within a few hundred feet of the flightline holds more than 100 motor homes. In addition, the vendors had excellent placement for their exhibits.

FESTIVAL OF GIANTS

GIANT-SCALE IN THE WINDY CITY

Top of page: Art Zinkel's 1/4-scale CAP 232 started out as a Lanier* kit. Art (Glenwood, IL) covered this 14 1/2-pound model in MonoKote and installed a U.S. Engine Products* US41.

This 1/3-scale Balsa USA* "heavy iron" Super Stearman was built by John Anzalone of West Chicago, IL; it uses a Brison 6.4 engine.

Above: Jim Nilosus of Addison, IL, brought this F6F Hellcat to the competition sporting its Sachs* 5.2 and Robart retracts.

Tom Lazar, Gary Dye and Bob Kraus's Robart P-38 prototypes sit ready for action.

Top: four MDS* 68s help Greg Hahn's (Lewisville, IN) Boeing B-17 get off the ground. Greg pulled off many accurate scale maneuvers during the event. Above: Gary Doeren built his Gilmore Red Lion in Green Bay, WI. This model of the well-known Thompson Golden Age racer is powered with a Zenoah* G62. Left: this He-111 has all of the operating features of the full-scale craft. Built by Carl Bachomber, it also features two 3W-24 1.4ci engines.

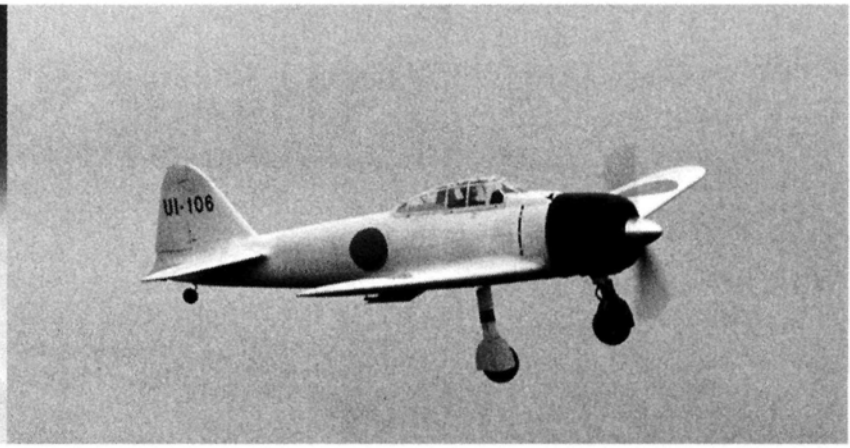
The weather and forecasts were a bit sketchy throughout the weekend, and that limited the number of entrants, but the selection of aircraft was still outstanding. As can be expected for any model-airplane meet, many Lasers, CAPs and Extras in a wide range of sizes—some as big as 40 percent—were being flown and displayed. As is the standard, Cubs were all over the place; however, one Cub literally towered over the rest. This ½-scale, clipped-wing craft had a wingspan of about 17 feet!

It was nice to see the large turnout of warbirds. One of Chicagoland's best parts was certainly the flight show put on by Greg Hahn and Carl Bachluber with their B-17 and B-24, respectively. These magnificent 13-foot bombers flew in close formation, creating the breathtaking sound of eight engines running in perfect harmony. The engines in both bombers ran perfectly during their several flights.

Three prototypes of the Robart Mfg.* P-38 were on display. I have never been to a scale meet, or even heard of one, that had three P-38s entered! Instantly, I saw that giant scale suits these planes very well.

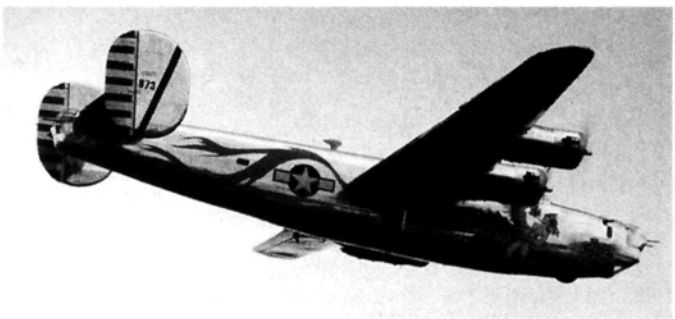
Above: Jerry Polz's (West Chicago, IL) clipped-wing Cub actually has a wingspan of 17 feet! Powered by a 6.4ci engine, this craft was painted to look like the personal Cub of Hazel Sig of Sig Mfg.

Right: this Me-109 appeared at Chicagoland, thanks to Jerry Desbach of Cottage Grove, MN. It has a 102-inch wingspan and is powered by a Zenoah G62.



Left: Carl Bachluber's B-24 and Greg Hahn's B-17 practice some scale maneuvers over St. Charles, IL. Right: owned by Doug Imes of Greendale, WI, this 1/5-scale AGM-3 is powered by a Sachs 4.2 and is said to be a nice flying warbird.

This B-24J is the creation of Carl Bachluber. Its four Saito* 91 4-stroke engines produce a very scale sound.



These 50-pound models are powered by two Zenoah G-62's—big-time horsepower. The fuselage pod and the twin booms are fiberglass, as are the stabilizer and vertical fins that are molded in one piece. The wings are attached on vertical aluminum braces. The firewalls, landing-gear mounts and wing plug-in hardware are factory installed. These P-38s use 14 servos to operate the control systems and also feature cockpit detail by Dynamic Balsa Design*.

Only one P-38 was flown, but from what I could tell, its takeoff and landing characteristics were excellent. I don't know its top airspeed, but I would say that 150mph is a conservative estimate.

Robart will make this P-38 in Wisconsin and offer it as a kit. You will be able to buy the regular kit or a version with a complete hardware package and custom Robart retracts. Tom Lazar, Gary Dye and Bob Kraus brought their P-38s to Chicagoland, and Robart began to take orders. Keep your eye out for more of these impressive warbirds!

The Chicagoland Festival of Giants has a reputation of being very social and family-oriented, and this year was no exception, with people interacting under the tents and in the various motor homes. On Saturday, non-modelers were invited to tour antique shops and other areas for which St. Charles is noted. Then the Fox Valley Club hosted a free luncheon for the group that was enjoyed by all.

Saturday night, Bob and Sylvia Walker hosted a free barbecue dinner for all the entrants and workers at the Robart manufacturing and distributing facility about five miles north of the flying field. The modelers really enjoyed the open-house tour of the Robart facility: this place is a modeler's dream come true. Beautiful RC models—most of them scale—hung all over the place. Bob and several of his employees answered questions and demonstrated their products. A big outdoor tent was set up in which to feed the hungry troops.

Contest directors Mike Kostecki and Don Bennish, IMAA Chapter 449 members and the rest of the Fox Valley Club did a great job organizing a first-class festival. It's a great place to fly. I had a great time and plan to attend again next time. See you there, and don't forget to bring your latest giant-scale RC project. For info on the next event, call Mike Kostecki at (800) 555-3731, or Don Bennish at (630) 983-7971, or send email to IMAA16955@aol.com.

Made from Ziroli plans, Jim Nicosia's classic DC-3 sports two Zenoah G38s, a JR radio and Robart DC-3 retracts. The plane was built by Roger Layton (Rockford, IL).

*Addresses are listed alphabetically in the Index of Manufacturers on page 198.

From the publishers of Model Airplane News

RADIO CONTROL
microFLIGHT

THE WORLD OF AT-HOME RC

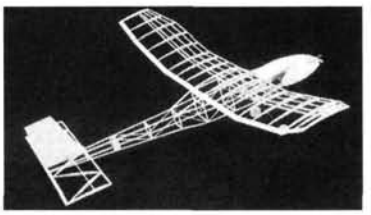
Cloud 9

by John Worth
jaworth@bellatlantic.net

I bought my first micro (CETO) single-channel RC set in 1995. I was inspired then to write a poem to kick off the first Cloud 9 newsletter. The words are still appropriate and are offered here to celebrate the first *RC MicroFlight* newsletter:

"I thought that I would never see
a hand-launched glider with RC.
*But that was before I got up here**
and dreamed of future RC gear." (*Cloud 9)

Here we go; we're near the end of 1999 and are looking ahead to 2000; but we're also stepping back for a moment to take a look at what has already happened in the world of micro RC.



The framework of Dave Robelen's rubber-powered RC model.

Obviously, it is now much easier for newcomers to be part of the RC micro-flight world than was true just a few years ago. There are many more

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Flying at home

The garage door opens and out taxis a radio-controlled airplane.

In this case, the Braun Modelltechnik Mouse. Throttle is advan-ced and it rolls about 1 foot then pulls up into a vertical climb and continues up until it clears the roof of the house. The small aircraft then performs a variety of spins, loops and rolls (for 15-second mpeg videos, see the expanded version of this article on www.rcmicroflight.com/nov99). I make a few passes between the two trees, an inverted limbo under the clothesline and then a perfect landing at my feet. Nope, it is not a dream, not dangerous, and not a video game. This is the new world of micro RC. For the past two years I have been enjoying the freedom to fly in my own front yard with the availability of small and lightweight equipment.

Todd Long performs aerobatics with the Mouse while standing in his front yard.

Flying in the front yard has

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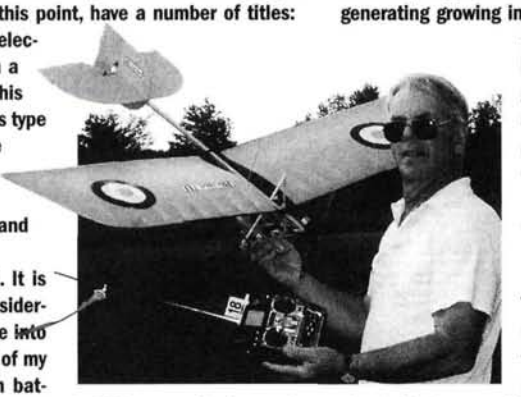
Ikarus Bleriot III

by Nick Ziroli Sr.

Modern circuit-board technology and sub-miniature electronic components have made possible the new generation of micro RC airborne systems. This has brought about a new category of RC models that, at this point, have a number of titles: indoor flyer, slow flyer, or park flyer. These are electric-powered, ultralight models that can fly in a small area or indoors at very low speeds. This Ikarus Bleriot III is my first experience with this type of model, and I must say it is a lot of fun. The Ikarus kits of the Bleriot III and its almost identical sister ship, the Grade Eindecker, are manufactured in Germany and imported by R/C Direct.



The Bleriot III is a very interesting model. It is obvious that light weight was the primary consideration. A lot of thoughtful engineering has gone into developing this model. The ready-to-fly weight of my model is 10½ ounces with a 7-cell, 270mAh battery. Its wingspan is 50⅜ inches, and its wing area is 480 square inches, not including the 2½-inch center gap between the wing panels. The wing loading is 3.2 ounces per square foot, which is as light as a feather when compared with the 50 to 60 ounces-per-square foot wing loading of the giant-scale models I usually fly. I can't fly those in a tennis court, a gym or my backyard they way I can the Bleriot III. This capability is generating growing interest in the backyard and indoor flyers. Good small-motor systems and new battery technology are making smaller, lighter models possible. Manufacturers are aware of the growing interest in lightweight models and are developing sub-miniature receivers (see the November 1999 issue of *Model Airplane News*, or look at the website www.rcmicroflight.com/library) and servos to make them possible. R/C Direct has a broad line of slow flyers and appropriate control systems available from Germany.

CONSTRUCTION

The Bleriot III is a high-quality kit. All the parts are nicely made and assemble well. The only weak spot I found was the instructions. (Traditional plans are not included; none are needed.) Good photos are included on the instruction sheets, but many written details that should have been included have been overlooked. I think this model could be built in one long evening if a different construction sequence was followed. All the molded foam parts that require

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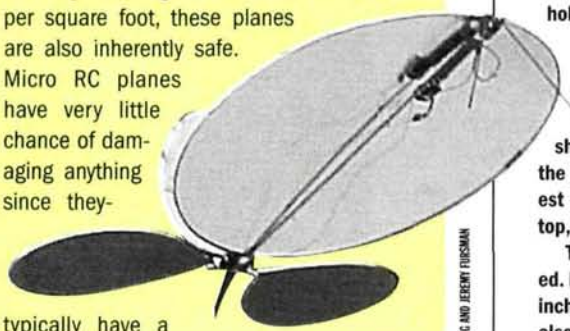
Flying at home

Continued from page 51

been a dream of mine since I started flying RC in the early 1980s but not until recently has the technology become available. With a few small manufacturers now making reliable sub-micro equipment, it is easy and affordable. No longer does one have to be a genius and custom-build radio equipment or design an airframe.

Flying at home is not the only airfield I have now. I get to fly at lunch, in the middle of the night under the lights at a local park-n-ride, in a school gym and in many more places. Two things will keep me out of the air—wind and rain.

With a flying weight of 3 to 5 ounces and a wing loading of around 3 ounces per square foot, these planes are also inherently safe. Micro RC planes have very little chance of damaging anything since they typically have a top speed of less than 10mph and many can easlily put around at 3mph or so.



The reflection on the underside of the Mouse indicates an airfoil like curve in the covering material.

PHOTOS BY TODD LONG AND JEREMY FUHSMAN

Models to suit most types of flying styles and abilities are available. They range from scale designs to extreme slow flyers, and some, like the Mouse (above), are highly aerobatic. Construction ranges from a standard, all-balsa, built-up to an all-composite structure that is very strong and lightweight. I used to walk by the free-flight models at the hobby store, but not anymore. Those little free-flight models can now be fitted with RC, and I and others have done so successfully (see Tom Hunt's Dumas Bearcat conversion article in the November '99 *Model Airplane News* and at www.rcmicroflight.com/library).

So take a break from mowing the lawn on Sunday morning and get some flying in!

—Todd Long
rcpilot@flash.net

Editor's note: to get more information on the Mouse, contact Northeast Sailplanes (802) 658-9482, or Todd Models (425) 503-4617.

Ikarus Bleriot III

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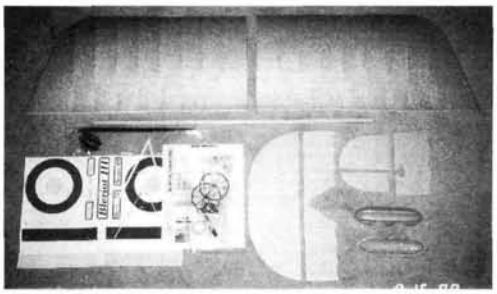
gluing should be assembled first so they are dry when needed later. White glue, such as Weldbond or Pacer's Formula 560 Canopy Glue, work well for gluing the foam parts. A tube of glue is included with the kit, but nothing is said about what to use it for. The labeling is in German, so I chose not to use the included glue for anything. The carbon-fiber wing spars must be glued to the leading and trailing edges of the foam wing panels. These molded foam wings are exceptionally well made. The surfaces are smooth, and they are very light—1 ounce per panel, including the carbon-fiber spars and the tape that covers them. The only other foam part to be glued together is the fuselage gondola. Don't use epoxy on the wing or fuselage; it is messy and adds weight.



The Bleriot III shown right out of the box.

The fuselage is a length of 3/8-inch-square, thin-wall aluminum tube. Since it's square, it is easy to align and glue parts to it. Slide the molded-plastic wing mounts onto the fuselage tube. The front of the fuselage is the end that has a hole through the top and bottom. There is one hole in the bottom at the tail end for the skid. Glue the main landing-gear struts to the bottom of the fuselage, as shown in the instructions, with a CA glue such as Zap. Roughen the surface of the aluminum with sandpaper where parts are going to be glued. Make sure that the edge of the plywood plate that is straight faces the back. The servos are mounted on this piece. Assemble the front landing-gear struts and axle as shown. Insert the gondola support dowel (the longest one of the three that are included) through the holes in the fuselage, and glue the gondola into place; I used 5-minute epoxy here. The shortest 1/8-inch dowel tailskid goes into the hole at the rear. For added security, I pierced a hole at the top, too, and used Zap to hold it in place. Then, I installed the wheels.

The tail surfaces are foam sheet about 3/32 inch thick. The hinges are clear tape, which is included. I felt that the elevators were too flexible from one side to the other across the rudder. A 1/64x3/8x2-inch plywood joiner was added to the top and bottom with a little 5-minute epoxy; thin balsa would also work. Hinge the elevators with the clear tape. I think it would be easier to apply the stick-on stripes to the rudder before hinging, if they are desired. Hinge the rudder only to the upper fin. Add the control horns. There are no location dimensions for these in the instructions, so I placed the rudder horn 3 inches from the top and the elevator 6 1/2 inches from the end. Epoxy the stabilizer to the top of the fuselage. Be sure it is centered and square. Epoxy the fin to the top of the stabilizer. Again, make sure it is centered and square. Add the bottom fin and hinge tape. I found that the stabilizer hinge line would not stay straight, and this caused the elevator to travel erratically. A thread brace from the top of the fin to the tips of the stabilizer and to the bottom of the fin holds the tips securely.

CONTROL SYSTEM

The servos are glued into place on the plywood mounts. I used a pair of JR's new no. 241 sub-micro-servos. If these aren't the smallest production servos available, then they are very close to it. They weigh 1/3 ounce and have a powerful output torque of 17 oz.-in. and include an assortment of output arms. Thin plastic line is supplied in the kit for the pull/pull controls. This is a good, lightweight control system.

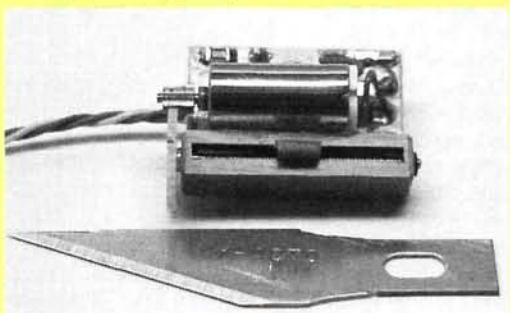
I used a Berg6 FM receiver, available from R/C Direct. This is a versatile, 6-channel receiver that

TECH REVIEW

WES-Technik LS-2.4 servo

by Todd Long • rcpilot@flash.net

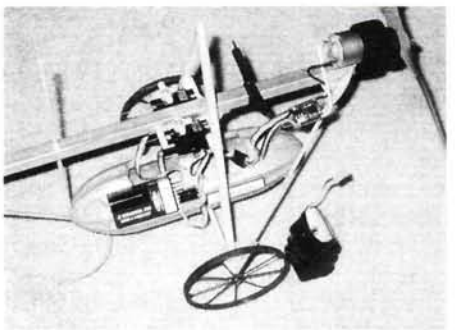
Weighing less than 3 grams (there are 28.4 grams in one ounce), the LS-2.4 servo from WES-Technik is the lightest servo on the market today. It works with all of today's receivers and operates between 3 and 5 volts. The current draw is also remarkably low, with a load current less than 100mA. With a physical size of



For the sake of comparison, an LS-2.4 servo from WES-Technik is shown next to a no. 11 X-Acto knife blade.

can be configured for either positive or negative shift signal. When purchased, it should match the transmitter it will be used with, for instance, negative shift for Airtronics or JR, and positive for Futaba or Hitec. It can be changed, if necessary. Mine came in the negative mode for my Airtronics RD6000 transmitter, and it works perfectly. It is a very lightweight receiver—16 grams, or about ½ ounce. Removing the case and enclosing the receiver in the included heat-shrink sleeve will further reduce its weight to 12½ grams. To make it universal, there is no keying of the connectors at the receiver, so they must be properly aligned when inserted. The edge of the receiver is clearly marked with the pin functions. Reversed connectors will cause damage, so again, be very careful here.

The speed control is the Ikarus Micro Speed Control 2G from R/C Direct. It is a tiny ⅛ inch thick

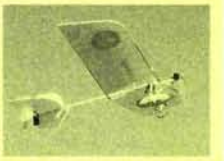


by ⅝x¾ inch, and it weighs only a few grams. It incorporates a BEC circuit to operate the receiver and servos from the motor battery. There is no motor cut-off with this speed control. As the battery runs down, motor power is reduced to the point at which the model will not remain airborne. At this time, there is still plenty of power to operate the radio and servos. It takes from 6 to 9.6 volts and can handle motors that draw up to 5 amps. The speed-control leads are soldered directly to the motor.

The motor and gear drive have been made specifically for the Bleriot III and Grade Eindecker. It appears to be a 280-size motor with a gear reduction of about 3 to 1, and it swings a 10½-inch prop (included). I did not care for the way the plastic gear and prop run on the threads of the prop shaft screw. This should be a shoulder screw or at least have a bushing in the reduction gear. I have over an hour running time on my motor, and it has loosened a little. If it becomes excessively loose, I'll bush it with brass tube.

Capacitors are included and must be soldered between the motor terminals and to the case. These reduce motor electrical "noise" that can cause radio interference. The motor gear housing fits over the front of the fuselage tube and is glued into place at about 2 degrees of downthrust angle. The receiver was in the rear cockpit, and the battery was in the front. I used a 7-cell, 8.4V, 270mAh battery pack to produce a 10½-ounce model. Balance the model as shown in the instructions. I did not glue the plastic wing mounts into place; instead, I taped them until I was sure the balance was correct. After a few flights, I moved the wing back slightly to obtain a neutral elevator trim.

SPECIFICATIONS



Model: Bleriot III
Manufacturer: R/C Direct
Type: RC electric slow flyer
Wingspan: 50 in.
Wing area: 480 sq. in.
Weight: 10 oz.
Wing loading: 3.2 oz./sq. ft.
Motor used: Ikarus no. 160611, designed for Bleriot III
Speed control used: Ikarus Micro Speed Control 2G no.160533
Battery req'd: 7 cells, 8.4 volts, 270 to 800mAh, 270 to 350mAh recommended
Radio req'd: micro-size receiver, at least 3 channels, 2 microservos
Street price: $59.95

Features: well-engineered, good-quality kit; nice molded foam wings; some prefabrication; complete kit; easy to build and fly.

Comments: fun to build and fly; a real change of pace for me; good first-time electric slow-fly model.

Hits
- Well-engineered, unique design.
- Good quality.
- Completeness of kit.
- Excellent flight performance.
- Accessory motor is a good match.

Misses
- Instructions could be more detailed for novices.
- Stabilizer too flexible; needs thread braces.
- Accessory motor should have a better prop-shaft bearing.
- Picture on kit box is of an older Bleriot II; some differences.

FLIGHT PERFORMANCE

Flying the Bleriot III is a lot of fun. It is probably one of the easiest to fly RC models that I've ever flown. Perform the test flights at a large, open area such as the local flying field or park. Once you have seen how little room is required to operate the Bleriot III, you will realize that it can be flown just about anywhere. I thought this was going to be a dead-calm-weather flyer but was surprised by how much wind the Bleriot III could handle. Do the test flights and trimming in calm air. Flight times with the 270mAh battery pack can range anywhere from 4 to 6 minutes. This will depend on battery charge and throttle management. A larger battery can be carried; up to 800mAh is claimed. This would make very long flight times possible but would greatly reduce the model's slow-fly features. I would limit the battery size to 350mAh and take advantage of what the Bleriot III is all about. If you have had any thoughts about trying a slow-fly RC electric model, give the Ikarus Bleriot III or Grade Eindecker from R/C Direct some serious thought. They live up to their claims. R/C Direct may be reached at (619) 277-4531.

21x3x9mm, it fits in very small planes. The servo has a rated output force of 175 grams (6.2 ounces).

Unlike standard servos, it does not have a servo arm but instead has a tiny horn that rides on a jackscrew. The tiny motor has a 7-tooth pinion gear that drives a 32-tooth spur gear attached to the jackscrew. The horn is able to travel proportionally 6mm up and down from its center point for a total of 12mm of travel. Full deflection of the servo occurs in 0.2 second.

Attached to the tiny horn's bottom is a brush that rides on a carbon pot. This setup allows the horn to work in a linear fashion. Predrilled into the horn is a small hole through which a small piece of piano wire can be inserted and then attached to a pushrod. Since the servo does not have a case or mounting tabs, it may be troublesome to install. I install my servos by gluing a small piece of ⅛x¼-inch balsa to the side of the jackscrew case with medium CA glue. The small piece of balsa can be glued to the side of a balsa or carbon tube fuselage. When the servo needs to be removed, just cut through the balsa mount. Gently scrape the CA off the side of the jackscrew case and glue on another balsa mount.

The servo comes with a small, JST-type connector. Some currently available microreceivers accept this plug. If you wish to change the plug, remember that red is positive, black is negative and white is pulse. This servo should work nicely in the increasingly popular Mosquito hand-launch gliders as well as in slow flyers. Most slow flyers have a BEC built into the speed control; the BEC drops the flight-pack battery down to a level at which it's safe for the radio to operate. When you use this servo in a glider, be sure to run between 3 and 4 cells so the voltage stays in the 3 to 5V range of the servo; higher voltages may burn up the motor.

Continued on page 54

Continued from page 51

Cloud 9

sources of micro-components and several manufacturers of very small RC sets. It's relatively easy now to get suitable motors, servos, receivers, batteries, etc., and there are many kit and ARF airplanes in which to put the equipment.

A few years ago, we saw a lot of scrambling to find '50s- and '60s-vintage pulse proportional transmitters to operate our micro, single-channel receivers and newer versions of the old Adams-type magnetic actuators. Fritz Mueller (Columbus, GA) revolutionized that aspect of micro RC by producing a new version of this kind of actuator, and his weighed only 1 gram. Fritz also modernized the old single-channel Albin receiver design with new circuitry that culminated in his "No-Cal" version weighing only 2 grams (with batteries!).

Along with people such as Phil Smith (Adrian, MI) and a handful of European innovators, Fritz showed us what could be done.

In all of this, the past has shown the way to the future. Almost everything we're doing now is smaller, lighter and performs better. Among many examples I could give is an early '90s Futaba receiver with a built-in electronic motor speed controller that weighed just over 1 ounce. Now we have the new Sky Hooks (Canadian) "Hybrid" receiver that has an internal motor speed controller. The Sky Hooks unit weighs less than one fourth the Futaba unit and is about one tenth its size (See Don Edberg's review of this unit at www.rcmicroflight.com/Nov99).

WHAT'S MICRO RC ALL ABOUT?

The word "micro" is somewhat misleading. Smaller, as far as models go, is not necessarily so. "Micro" has more to do with the size of the equipment a model carries. It's true that smaller and lighter components have made possible smaller models, but they have also made possible lighter and therefore slower models. That's the significance of the micro movement: the introduction of slow flying models that don't need a lot of flight space to fly in so they can be flown close to home—in ballparks, parking lots and even many backyards!

Today, a relatively large model—4-foot-wingspan or so—can be flown in a much smaller space than has been typical for a model of such a size. Yet the same technology has also made possible the tiniest of models (down to 3-inch wingspans!).

The slowness of the micro world is coupled with quietness, so models are now acceptable at many sites that were previously off limits.

Micro RC flying also tends to be less of a big-group affair (except for special gatherings) because many sites can be used by groups with different interests. Small groups or individuals are no longer limited to using a big club field and can fly in their local park or neighborhood.

Micro RC attracts new blood and modelers who have been out of the hobby for a while. That should be good news to manufacturers looking at the potential growth of this market.

Many have looked forward to the day when one can fly an RC model in the home—at least in a large room. The history of model aviation has always dangled that dream in front of us. It's now close to happening.

The developing interest is worldwide and growing rapidly and will only be reinforced as interest in the hobby is further publicized via electronic and print media.

Now for a look at some micro projects and technology:

RUBBER-POWERED RC

Dave Robelen (Farmville, VA) reported on his 30-inch-span (P-30 size) model weighing 50 grams (less than 2 ounces) with 10 grams of rubber. It has a single-channel 27MHz receiver connected to a 1-gram BIRD magnetic actuator operated by two tiny no. 932 hearing-aid-size alkaline cells providing 3 volts. (See photo at article opener).

Says Dave:

"This project was designed for free-flight competition but was also intended to be an RC rubber-powered model with acceptable performance. Another objective was to retain the cabin and landing gear without serious performance penalties. In one setup, the model is eligible for the P-30 free-flight event, while with a folding prop, it may be used in the unlimited category. The folding-prop option was chosen as the best RC case because it offers significant improvement in the glide.

"... The RC equipment was installed at the beginning and left in the model for free-flight events (turned off, of course). The BIRD was installed full size and turned out to be a tremendous asset to trimming the model as a free-flight. In essence, the (rudder) tab functioned as a magnetically biased trim tab that tended to lose its deflection with an increase in airspeed. This made trimming for a circle safe and easy .... The experience I had flying 'rubbered' RC showed the practicality and value of this very inexpensive form of lightweight RC."

SPEED CONTROL FOR CO_2 MOTORS

Until recently—except for one or two of the larger types—CO_2 motors were essentially set at a fixed speed during a flight (except when the power died at the end of a run). A few ingenuous *Cloud 9*'ers tackled the throttling problem and came up with a way to provide speed control during a flight.

A couple of examples were described in the June 1999 *Cloud 9* newsletter (available from John Worth, jaworth@bellatlantic.net). Simply put, a servo connected to the cylinder of the CO_2 motor was used to rotate the cylinder into or out of the threaded crankcase. As the cylinder was rotated, it effectively increased or decreased the clearance between the piston and the valve in the cylinder head and provided a longer or shorter duration of CO_2 injection per stroke.

TECH REVIEW

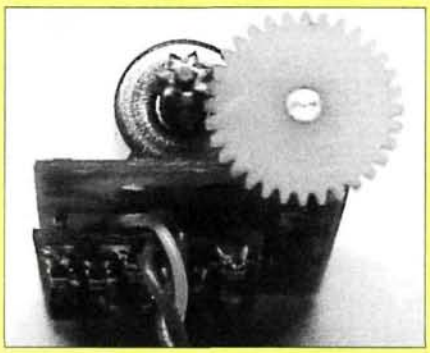
WES-Technik LS-2.4 servo

Continued from page 53

Solutions

I have been using this servo for almost two years and have discovered some solutions to a few of its shortcomings. For example, sometimes the gear mesh is a little loose; to cure this, I pry off the motor by applying pressure to the pinion gear with my fingernail. Once the motor has popped loose, I scrape the old glue off and use medium CA to reattach the motor with the proper amount of gear mesh. (The motor may have to be glued on at a slight angle.)

I have had a servo arm move to the end of its travel limit and then lock up. This can happen when a receiver glitch causes the servo to travel to the extreme limit, or when I try to force the servo beyond its limits by setting it up with a V-tail configuration or turning up the ATV (adjustable travel volume) too high.



Pinion and spur gear.

Mort Binstock (Pittsburgh, PA) and Abbott Lahti (Cambridge, MA) were among the first to try the idea, using GMot 120 or 63 motors with microservos to do the rotation. Mario DiDiego (Plainview, NY) did it with the GMot 120 twin CO_2 motor to show that the idea would work by rotating both cylinders simultaneously through a simple bellcrank operated by a microservo.

We hear that some CO_2 motor manufacturers may offer their own versions of a speed control. This will probably involve a form of moving the valve in the cylinder head itself, rather than rotating the entire cylinder assembly, but one way or another, we can expect that variable speed control for CO_2 motors will become readily available on a production basis.

This tiny Gasparin G-10 CO_2 motor has a displacement of only 10 cubic millimeters, runs for 2 to 3 minutes and is suitable for 12- to 18-inch-span rudder-only RC models that weigh less than 1 ounce.

MR. PROLIFIC

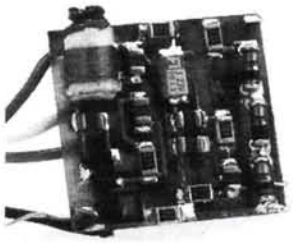
Abbott Lahti did some great things with RC some years ago—notably, a small (for that time) model he called "The Rodent"; this was a 40-inch-span, 26-ounce, low-wing sort of semi-scale de Havilland Chipmunk. At about the same time, he also developed what he called the "Lahti decoder"—a high-rate, proportional-control system that provided "full house" performance with an airborne weight of only 7 ounces—an outstanding achievement for those early days.

More recently, Abbott offered his ideas and services to the micro RC field via *Cloud 9*. A significant contribution was the design and production of a small modulator circuit board that could be used to convert old '50s and '60s single-channel transmitters so that they'd be able to proportionally pulse signals for variable rudder and/or elevator actuators. Along with this, he came up with other very small, light circuit boards that could be added to single-channel receivers to provide proportional pulse controls.

The effective result was to provide, in much smaller and more reliable form—and at reasonable prices—the means to obtain an electronic form of what was called "Galloping Ghost"—two proportional controls from a single-channel system but without the old cumbersome and cantankerous electromechanical problems of the vintage systems.

Abbott then developed an improved version of the old Albin single-channel receiver. He calls this the "RP27" and offers it in two sizes:

- 5/8x1¼ inches;
- 5/8-inch square (half the size)—achieved simply by folding the small circuit board over on itself! These are the latest state-of-the-art super-regen receivers; they offer good range and freedom from noise glitches, and they make possible RC models weighing no more than 1 ounce. That's why they're called "Low-Cal"—the lightest such receivers available.



The 5/8-inch-square Lahti RP-27 single-channel receiver weighs only 1 gram (without wires). It operates on 3 volts (two no. 932 alkaline cells) to proportionally pulse a 1-gram BIRD actuator.

7-CHANNEL RECEIVER

Abbott has developed a series of other breakthroughs (more than I can discuss here!). Taking an idea from a *Cloud 9* subscriber—Dr. Eric Hope of Kingston, Ontario, Canada—Abbott produced an improved version on another of his tiny circuit boards. This board, added to a Hitec "Shredder" 2-channel receiver, provides a total of seven (!) channels of proportional control for servo operation.

This board—the DD7, a 7-channel digital decoder—weighs only 8/10 gram and may simply be taped to the back of the receiver; the wires weigh more than the decoder board!

Abbott also adapted this board to his single-channel flat RP27 receiver, and the whole assembly (minus wires) weighs only 2 grams. Still another unique micro circuit board is one that takes the output of a modern micro receiver such as the 3-gram 4-channel Garrett to provide high-rate pulsing of magnetic actuators so that the latter follow smoothly instead of flapping, as is typical of a low-rate system. This means that an ultralight multi-channel receiver can operate 1-gram actuators to provide a 3- or 4-channel proportional control system weighing less than a ½ ounce with batteries—something that's currently impossible to do with servos.

One more Lahti achievement: a circuit board to provide speed control for very small motors operating at 2.4 to 4.8 volts. The battery does not have to have a higher voltage than the receiver and the actuators need for operation, and this consequently saves weight in very small model systems.

This Hitec 2-channel shredder receiver was converted to operate on 7 (!) channels by taping a Lahti DD7 circuit board to the bottom. It operates regular microservos!

I could go on, but all this indcates real progress in overcoming micro-RC problems. Next month, I'll have more to report. Until then, happy flying!

Abbot Lahti products are described in the price list available from *Cloud 9* RC (see www.rcmicroflight.com/cloud9rc).

For an expanded version of this article, see www.rcmicroflight.com/nov99.

Two solutions to this problem are to keep the servo travel low by decreasing the ATV and to glue a small piece of a rubber band to each end, inside the jackscrew case, to prevent the arm from going beyond the limits of the pot. If the servo does lock up, unplug the battery as quickly as you can because the motor is still trying to center the arm. Then, use your finger to rotate the white gear to center the horn and plug in the battery. The servo should then center itself (see www.rcmicroflight.com/nov99 for an expanded review with color illustrations and an mpeg video clip of the servo in operation).

Below are a few simple rules for using this servo. Their use will prevent most problems.

- Use in models that weigh less than 4 ounces.
- Don't use extreme control throws.
- Stay within the 3 to 5V operating range.
- A conservative load should not exceed 100 grams (3.5 ounces) output force.
- Use small, lightweight control surfaces.

OK; what are you waiting for? Get some of these servos and start building a micro RC plane!

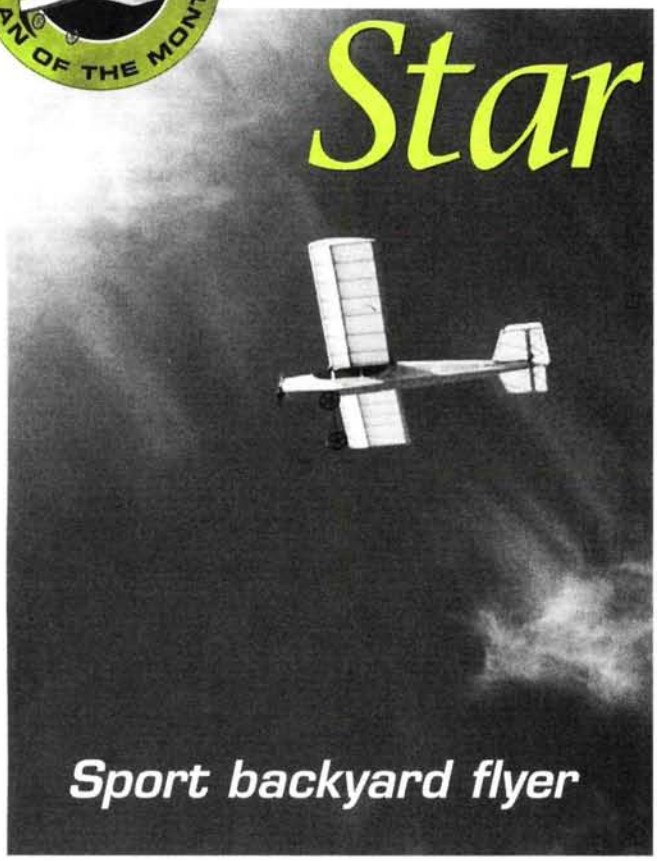
The next question is, where do you want to fly today?

For more information on this servo, see http://www.idnet.de/homepage/scholl.

The LS 2.4 servos are distributed by David Lewis of Homefly.com (216) 251-2517; Skyhooks & Rigging (905) 257-2101, and Todd's Models (425) 503-4617.

Star LITE

by Tom Herr
iflyherr@cris.com



Hurricane Floyd was battering us with 85mph winds as I finished the prototype StarLITE, and I had several frustrating days waiting for the weather to cooperate enough to allow me to make the first flight. Eventually, the sky cleared, all was calm and the sun's rays pierced the morning sky. Not having a proper charger for the Ni-Cd batteries I planned to use, I decided to make the first flights using a 9V lithium pack.

The parking lot at work was deserted as I advanced the throttle and the StarLITE leaped into the air. As it climbed quickly above the light poles and palm trees, my concerns about its having enough power to fly vanished. After a little trimming, it settled down into level flight at something less than ½ throttle. The controls responded well as it circled and flew figure-8s, and it was easy to stay within the 50x150-foot area that was free of obstructions.

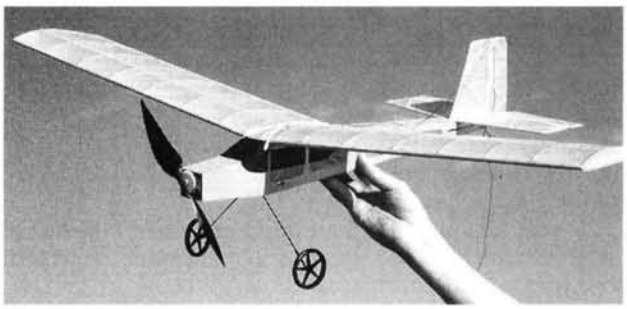
Distracted by flying the StarLITE and talking to people going into work, I lost track of how long the model had been in the air. I looked down at the timer clipped to my shirt sleeve and was surprised to see that it had been airborne for just over 20 minutes. There was still plenty of power available to climb, and ½ throttle would still maintain level flight. I decided to see how long I could keep it flying.

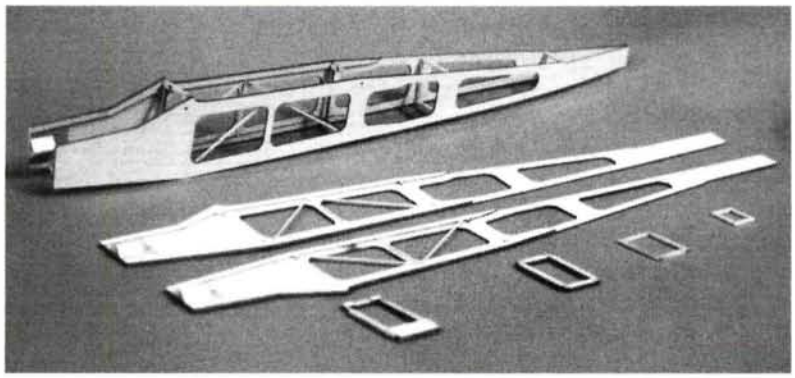
At the 1-hour mark, I started to think about landing. The parking lot was full and the sun was well above the horizon. A slight breeze had picked up, and I kept the model slightly above rooftop level to avoid any turbulence.

Finally, even though plenty of power was still available, the strengthening sea breeze told me it was time to land. The turbulence rocked the model gently as the throttle came back. Control was still precise as I guided the StarLITE down bet-ween the rows of parked cars, and it needed just a touch of power to reach my intended landing area. It touched down gently and rolled to a stop in less than one fuselage's length. As I reached to stop the timer, I was surprised to see that it showed a total flight time of 1 hour, 25 minutes. This was without a doubt the longest first flight that I had ever made, and the model had flown better than I had predicted.

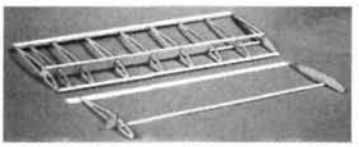
The next day, I decided to see what the maximum flight time would be with the lithium batteries. I started the flight earlier to minimize problems with wind later in the flight, and it lasted 1 hour, 47 minutes. It still had plenty of power left, but I brought it down because I had concerns about the transmitter's battery life. With higher-capacity transmitter batteries, I feel that the model could easily fly nonstop for 3 hours or more on the lithium pack. On subsequent flights with Ni-Cd packs, I had 5 minutes with the 7-cell pack and up to 10 minutes with 8 cells.

In designing the StarLITE, my basic intention was to build a small, conventional-looking backyard flyer. The airframe is built using mostly traditional materials and techniques. Its light weight and excellent performance were achieved by careful wood selection and by the use of some amazingly small airborne electronics and a highly efficient motor and propeller; in fact, the quality, size, performance and reliability of the radio and power system are truly remarkable. The receiver is the Sky Hooks & Rigging RX72-HYB—a postage-stamp-size 4-channel unit weighing only 4 grams and featuring a built-in electronic speed control with BEC function. I chose Hitec HS-50 servos for their light weight and small size; they provide the precise control needed to maneuver a small model in a limited area. The WES-Technik MSYS-524-1 motor has an 8.3:1 gear reduction that turns a 23x12-centimeter carbon-fiber propeller. This combination runs very smoothly,



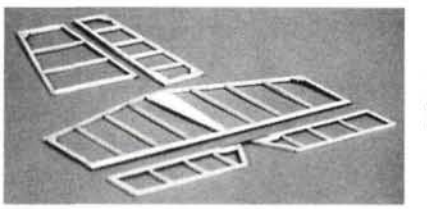


When sides and formers shown in foreground are finished they are assembled to make the fuselage box shown behind. ½2" sheet on top and bottom will complete the fuselage.



Finished left wing panel shown behind right wing that has just been started.

The WES-Technik DC 5-2.4 1A power system and carbon prop shown assembled on a plywood mounting plate.



The completed tail surfaces await their tissue covering.

produces plenty of power and is highly efficient.

Several types of airborne battery pack may be used successfully. For regular flying, traditional 50mAh Ni-Cd packs with 7 or 8 cells will power the model well. For maximum duration, use a pack of 3, CR2 lithium cells rated at 750mAh—3V cells making a 9V pack. These cells are not rechargeable, but you could use the rechargeable Tadiran lithium cells.

Building the StarLITE is rather simple. Carefully select lightweight wood, and use traditional model airplane cement such as Testors or Sigment for construction. Don't use CA glue for general construction, as it will add too much weight and makes sanding difficult on the small pieces of wood used. CA may be used to glue the landing gear, elevator joiner and pushrod ends.

The tail surfaces are built from 3/32-inch balsa. After covering the plywood, glue the control horns into slots and hinge the rudder and elevator with short strips of tape.

The wing is built in two halves. The lower trailing edge and lower main spar are pinned to the building board, then the tip rib, the second rib and the shear web SW-1 are glued into position. Now the first W-1 rib is glued into position using the angle on the shear web to set the angle for the dihedral. Finally, the rest of the ribs, the trailing edge, the top spar, the leading edge and the remaining shear webs are glued into place. When both wing halves have been built, they are glued together, and then the center ribs are notched to accept the top and bottom plywood dihedral braces, which are glued to the front of the shear webs directly in front of the spars.

The fuselage is a simple box structure. First glue the doublers, 1/16-inch-square braces and 1/4-inch-balsa motor-mount triangles to the fuselage sides. Then assemble the four formers. Glue formers F-5 and F-6 to one side and then add the other side. Pull the aft ends together, glue in the two remaining formers and glue the tail post. Now sheet the top and bottom with cross-grain 1/32-inch balsa sheet. The motor is mounted on a 1/32-inch plywood plate that's installed in the nose between the triangular mounting blocks. This should be a press fit; you can apply a little glue to the edges of the mounting plate to thicken it enough to achieve a snug fit.

I covered the entire model with Isaki tissue and finished it with two coats of thinned nitrate dope. Cover the tail surfaces separately and then glue them to the model. Be careful to keep the aft end of the model light.

The servos are just pressed into cavities in a small block of white foam that is glued to the bottom of the cabin area. Adjust the positions of the servo and batteries to get the model to balance at the point shown on the plan. Set the control throws to 5/8 inch left and right for the rudder and 3/8 inch up and down for the elevator.

For the scratch-builder, full-size printed plans are available from Herr Engineering Corp. for $5 (plus $3.20 S&H), and a complete kit is available for $36.95 (plus $4.50 S&H). Herr Engineering (407) 264-2488; Skyhooks & Rigging (905) 257-2101.

SPECIFICATIONS

Aircraft: StarLITE
Type: backyard flyer
Wingspan: 66 in.
Wing area: 216 sq. in.
Length: 25.5 in.
Weight: 3.5 to 4 oz.
Wing loading: 2.3 to 2.6 oz./sq.ft.

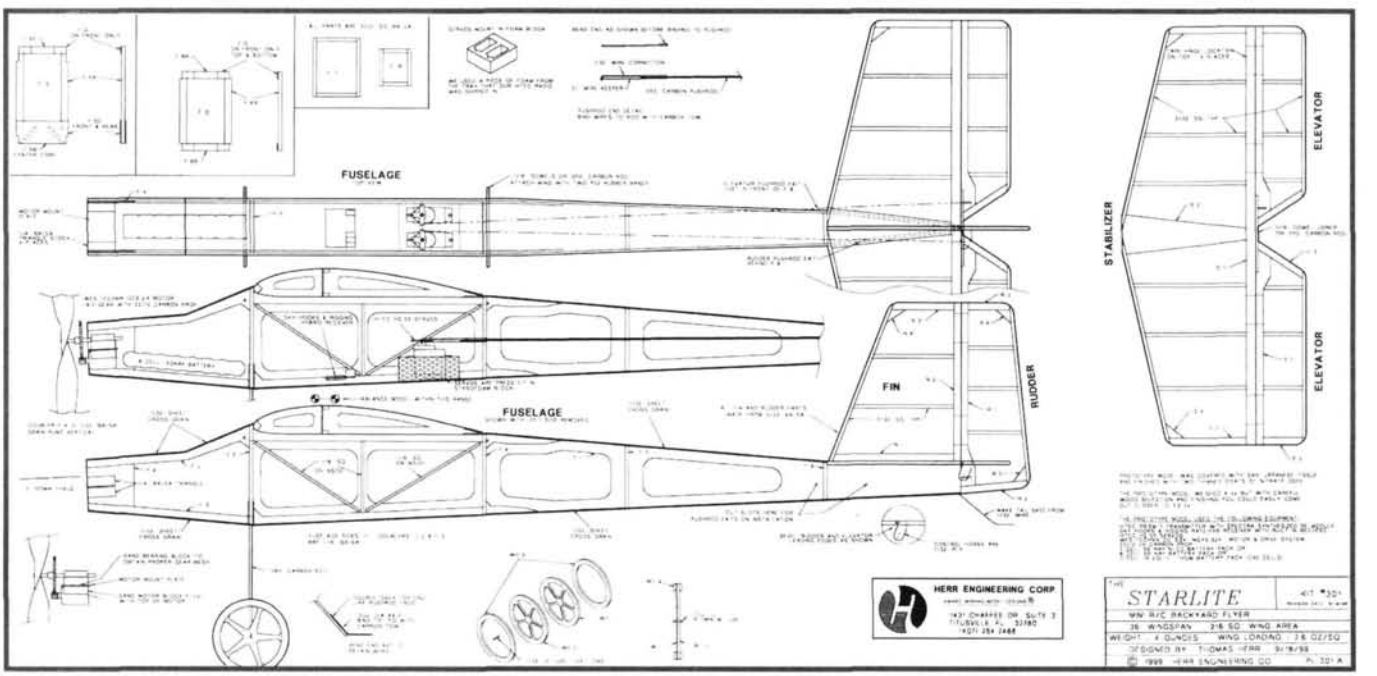
Power train: WES-Technik DC 5.24 motor with 8:1 gear ratio and WES-Technik 23x12 carbon prop; 7-cell 50mAh Ni-Cd, or 3-cell CR2 lithium non-rechargeable cells.

Control system: Skyhooks & Rigging RX72-HYB receiver with built-in ESC; two Hitec HS 50 Feather servos.

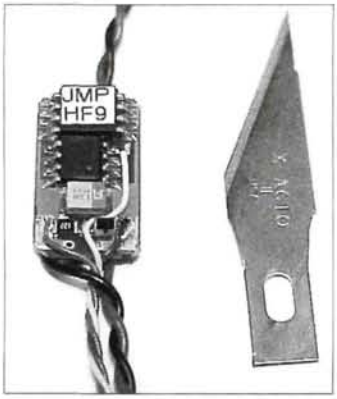
Construction: all balsa covered with doped Japanese tissue.

Comments: this easy-to-handle backyard flyer flies for 5.5 minutes using a Ni-Cd pack and for more than 2 hours using the lithium cells noted.

One of two plans is shown; both can be downloaded free at www.rcmicroflight.com/plans



Micro Scoop



JMP-HF9 High-Frequency Speed Control

Thanks to a revolutionary principle conceived by Jean-Marie Piednoir of France, the life expectancy of your valuable coreless motors will be increased significantly. This new, high-frequency speed control weighs a mere 0.9 gram and supplies smooth DC voltage to your motor along the whole rpm range, from idle to full speed. The JMP-HF9 works at a clock frequency of 60KHz! It smoothes the output voltage with a very small SMD coil and capacitor. Motor life should be increased because operating RC micro flyers typically means using motors at ½ or ¼ throttle. Moreover, your propulsion should last about 15 percent longer! Before this technology, speed controls would often send current spikes as high as 5 amps at ½ throttle to brushes or equivalents that transmit power to the commutator. This energy will no longer be wasted burning brushes but is fully available for motor operation.

SPECIFICATIONS

Technology: RISC micro controller
Functions
· Auto calibration.
· Safe start.

Operating voltage: 6 to 10.8 volts (13 volts max); can be modified to 3 to 4 cells.

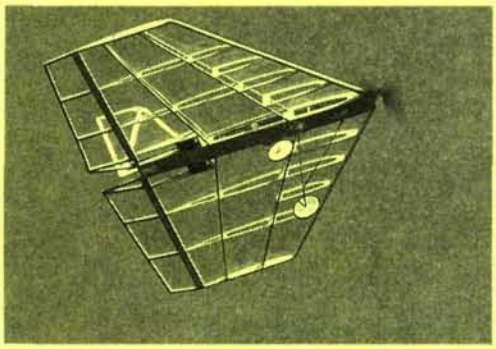
BEC: 5V max at 0.7 amp
Clock frequency: 60KHz
Internal resistance: 0.01 ohm
Response time: 0.2 second
Rpm reduction: at less than 4.8 volts
Current (amp): 1.5 continuous, or 3 max
Dimensions (mm): 4x8x17
Weight (without wires): 0.9 gram
Weight (with wires): 1.9 gram

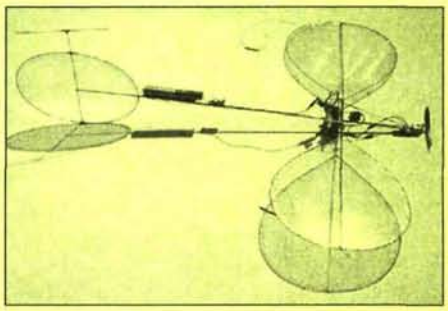
For further information, see www. http://ourworld.compuserve.com/homepages/jmquetin/tips4e.htm#VariaHFe
Todd Long • rcpilot@flash.net

OTHER ISSUE HIGHLIGHTS

Micro flyer Reviews

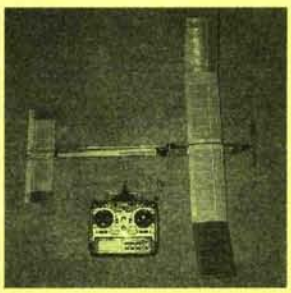
See www.rcmicroflight.com/nov99 for reviews of the Hobby Lobby Spad slow flyer (top), and the WES-Technik DeltaStar micro flyer.



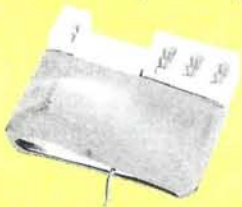


Heium Micro-Blimp project

See www .rcmicroflight.com/nov99 for the RC Heium Micro-Blimp project by Gabe Baltaian.



SkyHooks & Rigging RX72-HYB receiver/ESC hybrid



See www.rcmicroflight.com/nov99 for a review of the SkyHooks & Rigging RX72-HYB receiver/ESC hybrid unit by Don Edberg

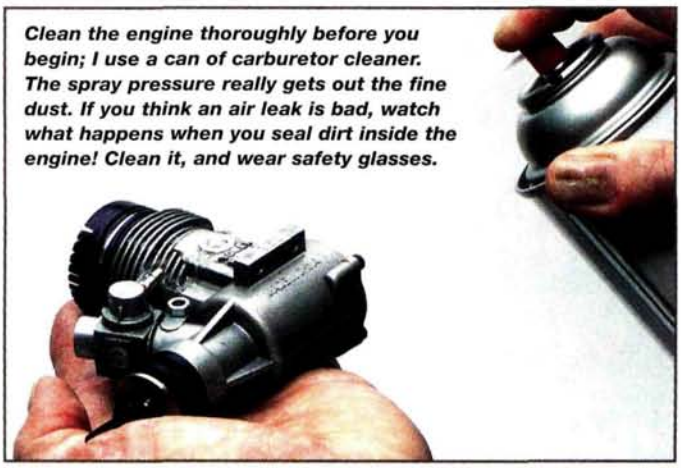
Other articles this issue include: ***Sheet Materials for Micro RC*** *by Jef Raskin, and* ***Electric Aircraft Design*** *by David Lewis.*

by Chris Chianelli

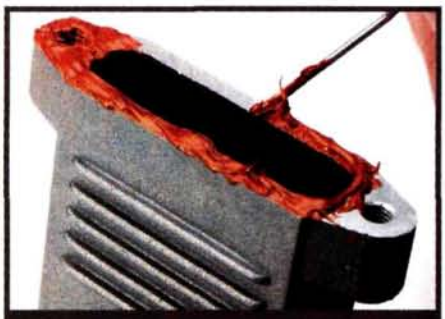
Death to evil air leaks

There's only one place you want your 2-stroke engine to be sucking air: through the carburetor. If even a little bit of air is leaking anywhere else, it will destroy the necessary negative crankcase pressure—the force that sucks the air/fuel mix into the engine. If your engine isn't drawing the right amount of fuel and air at all rpm levels, it will run poorly—or not at all.

Follow these steps closely, and when the last part has been bolted back onto your engine, you should be ready to go. This procedure is great not only for resealing a poorly running, leaky engine, but also for rebuilding older engines for which gasket sets may be too expensive or not readily available. In the past, when I've been unable to obtain a certain gasket for an otherwise good engine, I used this system in place of the gaskets and was rewarded with a perfect running engine; it works that well.



Clean the engine thoroughly before you begin; I use a can of carburetor cleaner. The spray pressure really gets out the fine dust. If you think an air leak is bad, watch what happens when you seal dirt inside the engine! Clean it, and wear safety glasses.

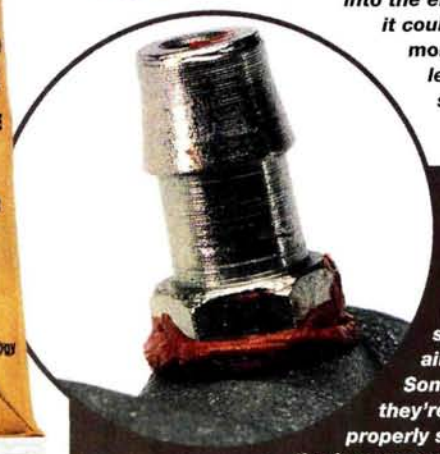


It isn't essential to seal the exhaust, but doing so will keep your model's engine compartment cleaner. Use a bit more sealant with exhaust stacks, since the mating surface between the muffler and exhaust stacks is sometimes less than precise. Yes; this stuff will hold up to exhaust temperatures.

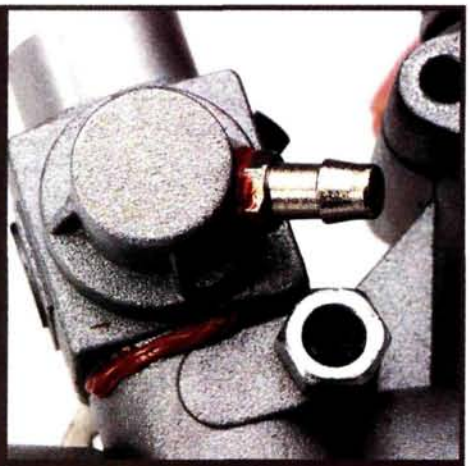
Garden-variety silicone sealants contain ingredients that can corrode the inside of the engine. When you shop for a sealant, read the package to make sure that it's suitable for high-temperature applications and that it is "sensor-safe" or "oxygen sensor-safe."

Less is more. Squeeze some sealant onto a piece of scrap paper and apply it with a piece of thin wire, such as an unbent paper clip, or a toothpick. Use just enough to ensure a proper seal and no more. You don't want excess sealant to get into the engine; it could cause more problems than it solves.

With a clean cloth, wipe away any excess sealant that oozes out of the joint when the screws are tightened. It makes disassembly easier and, if nothing else, the engine will look better.

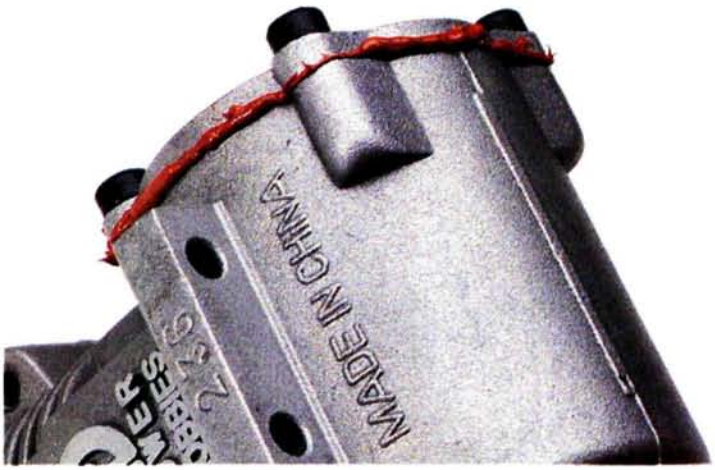


Fuel-inlet nipples are a potential source of air leaks. Sometimes, they're improperly sealed at the factory, especially when plastic gaskets are used instead of paper ones.



Many air leaks occur in and around the carburetor. Carb retainers and the area under the carb where it mates to the engine are usually the trouble spots.

Torn backing plate gaskets can be a source of air leaks. If you don't have a new gasket—no problem. This method works extremely well in place of the gasket. Don't be fooled into thinking that a backing plate with an O-ring is always properly sealed. It can leak just as badly as a torn gasket.



When you re-install the backing plate, apply an equal amount of torque to all of the bolts and wipe things clean before the silicone dries.

Seal the backing plate with a small bead of silicone. Seal right over an O-ring if one is present. Don't apply any sealant to the engine block because it might permit a tiny bit of it to be pushed into the crankcase when the backing plate is installed.

INFORMATION, PLEASE!

A few months ago, we printed a letter in "Airwaves" that read something like this: "Every time I fly my RC trainer, its .40FP quits about halfway through the flight. *Help!*" Roger Post answered the question as well as he could, but if you guys want us to help you, *you* have to help *us*. You must supply us with as much information as possible; important facts such as which prop you are running; which glow plug you use; which fuel you use (and tell us the percentages of nitro and oil, if possible); whether the fuel is old or new; whether you're running muffler pressure; and the location of your tank. Such information can help us narrow things down a bit, since we don't have the engine in front of us for a first-hand inspection. Even when sufficient information is supplied, it is still difficult to diagnose a problem without examining the engine in question. But with no information at all, it's next to impossible. So give us the info, and we'll do our best for you.

In the case of the .40FP that won't run out more than half a tank of fuel, I can offer a few guesses. It could be something as simple as a pinhole in the tubing inside the tank that the clunk is connected to. The engine will run fine until the fuel level drops below the pinhole, at which point the hole will start to suck air and the engine will quit. A pinhole can appear anywhere, however, so the entire fuel system should be checked. Other things to consider are crankcase air leaks; fuel-tank location; marginal piston/sleeve fit that leads to dubious fuel-draw as the engine reaches running temperature, or even old or contaminated fuel, which can make engines do strange things. Fuel can be ruined in many ways. Here are two:

Methanol is hygroscopic, which means that it absorbs moisture from ambient humidity. When fuel gets too saturated, it's ruined. When stored for any length of time, fuel containers should be tightly capped (and that doesn't mean left with the field fueling gear screwed to the top of the jug) and stored in a cool, dry place in which the humidity and the temperature remain as constant as they possibly can. Another fuel destroyer is exposure to ultraviolet light. Nitromethane is adversely affected by extended exposure to sunlight. Our fuel used to come in metal cans, but these days, it usually comes in plastic bottles, and this makes ultraviolet damage a more serious concern. If you can find a metal can, use it at the field to protect your fuel from the effects of ultraviolet exposure.

Don't forget to supply some data with your questions, and we'll do our best to give you correct answers. Oh yeah; and don't forget to have fun at the field!

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

A do-it-all RC simulator

Great Planes REALFLIGHT DELUXE

by the staff of Model Airplane News

Do you constantly dream of standing on the flightline, but always dismiss the thought because you'd be more likely to get frostbite than to have a successful landing? The snow keeps piling up, essentially burying your chances of flying until the spring thaw. Or do you simply want to learn how to fly a plane or heli, or do a rolling circle without damaging your plane? If you answered yes to either of these questions, Great Planes* *RealFlight Deluxe* may be the accessory you've been looking for!

RealFlight Deluxe *comes with everything you need to turn your computer into a flying field, including a real Futaba transmitter converted to plug into your joystick port.*

The major difference between the original *RealFlight* and *RealFlight Deluxe* is the addition of helicopters to the list of available aircraft. Quite simply, helicopters are more complex than airplanes, and the programming necessary to create an RC heli sim echoes this complexity. Realistic physics enable the environment to interact with the heli and vice versa; even the smoke coming out of the muffler seems real. The DirectX technology the sim employs even allows you to see the wires inside the heli's canopy! As with the planes, you can change the parameters of the model to customize it; with more than 300 changeable settings for the helis alone, you can do more than you could with the real thing!

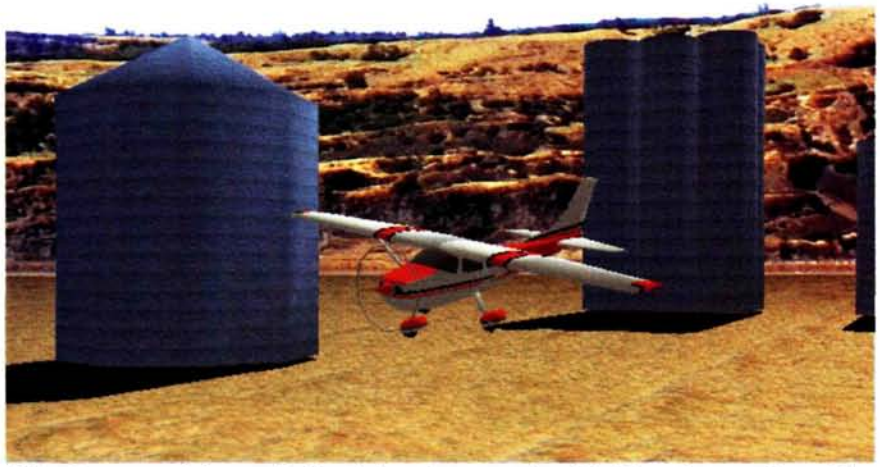
Great Planes has incorporated cutting-edge technology to create a realistic flying simulation, including variable and controllable physics such as thermals and wind, other RC planes flying at the same

AN EXPERT'S CRITIQUE OF REALFLIGHT'S HELIS

by Rick Bell

When I first saw the *RealFlight Deluxe* helis in action in Toledo, I was amazed by the graphics and wanted to give the sim a try—but so did everyone else there (seven or eight people were always in line to try it). I would just have to wait until a friend got one. When the editors of *Model Airplane News* called to ask if I would like to review the heli aspects of *RealFlight Deluxe*, I jumped at the chance.

RealFlight Deluxe offers 11 helis. Models range from an .049-powered model to scale beauties and competition .60-size machines. An electric heli is included, too, so you can see what it can do. One of the things I liked about *RealFlight Deluxe* was that I could configure the default models to fly like my own helicopters. There are far too many options to fully describe here, but some of the parameters that can be changed include the gyro, clutch, tail fins, servos, heli setup, engine, fuselage and main rotor. The list goes on, and there are many parameters that you can change within each option. For example, the gyro can be set up as a piezo or mechanical, and you can use head lock. You can set the ATV, gyro gain and pirouette rate plus

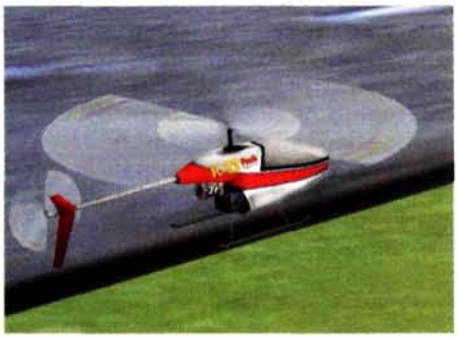


Silos, trees, spectators and other flying planes can be added to make your time at the sticks even more realistic.

time and even that annoying guy at the field who laughs at you when you crash and who eggs you on to try different tricks (you can turn this off). As with almost every option in this program, these effects are at your complete control. Shut off the wind, turn up the thermals, or add a mountain to your airport.

RealFlight Deluxe also gives you the option of altering whichever model you choose to fly. From the PT-40 trainer to the Ultimate Bipe, from the P-51 to the Space Walker, from the Impala .30 heli with training gear to the .60-size Foiler competition heli, each model has unique flying characteristics and special functions such as retractable landing gear (planes) and idle-up (helis). This not only enables you to experiment with various styles of model aircraft, but it will also help you decide whether you're interested in helicopters.

If you're not happy with the setup on the P-51, for example, you can edit its parameters. Make the wingspan longer, change the airfoil shape, replace the propeller and/or engine, play around with your thrust, or modify your plane in any of a hundred ways. You can even do several more settings. All of the options work the same way. You could actually take measurements from your heli and "build" a computer heli using a default model in the program, right down to the airfoils on the main blades, tail blades and flybar paddles. Talk about versatility!



One of the neat things about *RealFlight Deluxe* is its graphics. They are simply awesome! With the transparency option turned on, you can actually see through the canopy glass to the servo wires inside. All of the models are greatly detailed, and this helps make *RealFlight Deluxe* the most realistic simulator I've ever experienced. The big question is: how well does it work? I have owned several simulators, and *RealFlight Deluxe* is best at capturing the "feel" of an RC helicopter. The feel is so close to the real thing—and the models look so good—that some of the "fear factor" even starts to creep in. You just don't want to crash any of these great-looking models! I really had a ball using *RealFlight Deluxe*, and I look forward to logging many hours of great sim time.

SPECIFICATIONS

Minimum system requirements

- Windows 95/98
- Microsoft Direct3D-compatible, high-performance 3D-accelerated video card with a minimum of 4MB video RAM
- Pentium 200 processor
- 30MB available hard-drive space
- 16MB RAM
- 4X CD-ROM drive
- Super VGA monitor

Optimal system requirements

- Pentium II 300+
- 8MB video RAM
- 16X CD-ROM drive

Features: included Futaba controller or interface your own radio; PhotoField graphics technology, VirtualRevolution and RotoSonic sound technologies and RealPhysics technology at work; wide variety of planes, helicopters and airports; add-ons available; can edit crafts and radio parameters; fly using multiple views.

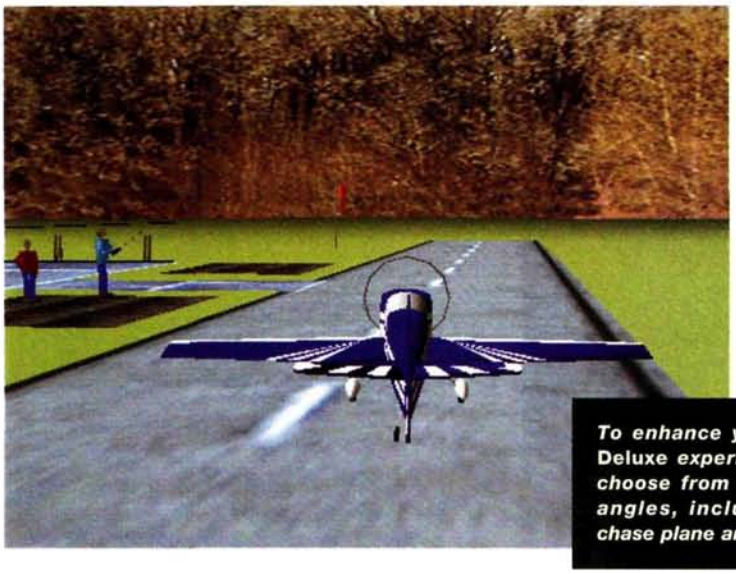
Comments: the *RealFlight Deluxe* RC flight simulator could be just the thing for learning how to fly or how to perform new stunts without worrying about ruining your aircraft, for experimenting with different types of aircraft before purchasing them, or just for keeping your fingers warmed up on stormy days and frosty nights.

Hits

- Many planes, helis and locales to choose from.
- Add-ons available for even more planes and airports.
- Your choice of controller or interface included in package.
- Variable physics such as wind gusts and thermals available.
- Can customize hundreds of aircraft and heli parameters.

Misses

- Some computer compatibility problems.
- Can fly through obstacles.

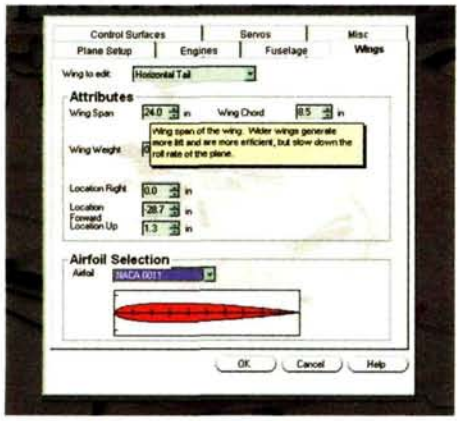


To enhance your* RealFlight Deluxe *experience, you may choose from any number of angles, including cockpit, chase plane and ground view.

major overhauls such as moving the landing gear or changing the leading- and trailing-edge sweep. But beware; making your wingspan 2 inches long won't work in this program, just as it won't in real life!

The manual comes included on the CD, and it can be viewed and printed out. Above and beyond the normal installation instructions, the manual will take you through any modifications you may wish to make to your aircraft or flying field. It also includes a glossary that covers both RC-specific terms for novices and words specific to this program.

When you purchase your copy of *RealFlight Deluxe*, you are given the option of buying it with a Futaba transmitter that has been converted to a controller for this program, or buying it with a special interface that allows you to use your own transmitter. The special Futaba transmitter is simply plugged into your game port, and the transmitter interface is plugged into a parallel port and into your transmitter. If you use your printer port, you can still plug your printer into the opposite end of the interface; both



The task of editing the parameters of your virtual model may seem daunting, but the graphics and help windows will guide you through what effects each change will have on your craft.

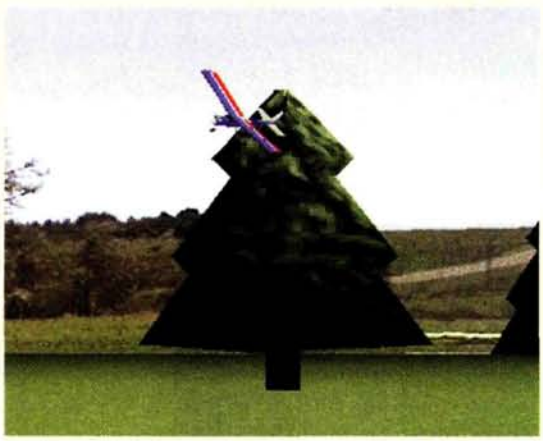
If you want to use your own transmitter, simply get* RealFlight Deluxe *with the transmitter interface. It is compatible with most major transmitters.

A BEGINNER'S THOUGHTS ON TRAINING WITH REALFLIGHT

by Geoff Cozine

As a newcomer to this hobby, I have been greatly concerned about the expense of replacing planes while I'm learning how to fly. Having a well-trained RC instructor, as I do, can allay most of these fears, but *RealFlight Deluxe* can help eliminate them altogether.

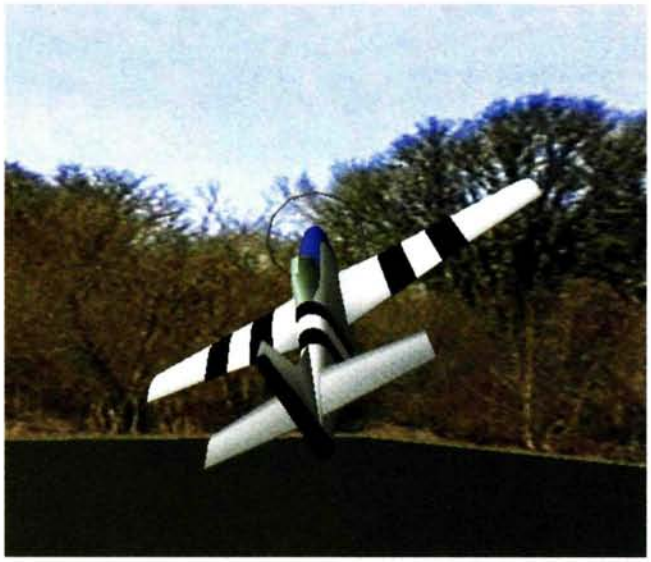
I started flying with *RealFlight Deluxe* before I had ever logged a minute of RC airplane stick time. I have had some experience with RC cars as well as with full-scale simulators on the PC, so the sticks felt fairly natural to my fingertips. I had some knowledge of the theories and skills needed for basic flight, but I was definitely a novice. An experienced pilot sat with me for a while to give me pointers as I learned on the simulator, then I worked solo. At the flying field that weekend, my instructor repeatedly commented that he was impressed with my progress. There's no question that the simulator helped a great deal.

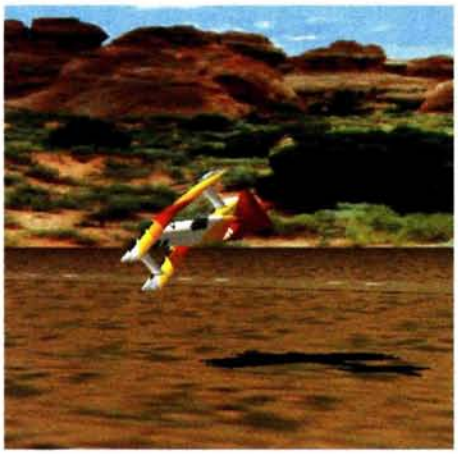


Note, though, that *RealFlight Deluxe* is not intended to replace an experienced instructor. It's great not to worry about crashing your aircraft or having to wait for the perfect day to go flying, but from my vantage point, I recommend

transmitter and printer will work! The interface allows for up to eight proportional controls (as opposed to the usual four), and you also get every feature of your radio, including programmable mixes.

One concern that has sprung up about *RealFlight Deluxe* is that some people have had problems with compatibility between the program and sound or video accelerator cards. Great Planes' web page allows you to update your software to the most current version (this will fix most problems). While there, you can also download a few extra planes such as a CAP, Piper Cub, or F4F Corsair. If you have difficulty downloading the update, try turning off some of the sounds or display options; this may help a lot of problems. You can also increase the size of the cache that the sim uses. If these ideas do not help, there is a fairly extensive troubleshooting section in the manual, and you can also call Great Planes' technical support.





Looking at a computer monitor has certain limitations—such as the absence of peripheral vision—when compared to being at a flying field. However, Great Planes has gone to great lengths to make its simulator as realistic as possible and has even included the option of looking at the sky or at a windsock for ground references. Whether you want to learn how to fly without the fear of crashing, or you simply want to keep your fingers warm during the winter, *RealFlight Deluxe* may be just the thing for you.

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.*

REALFLIGHT FROM A FUN-FLIER'S PERSPECTIVE

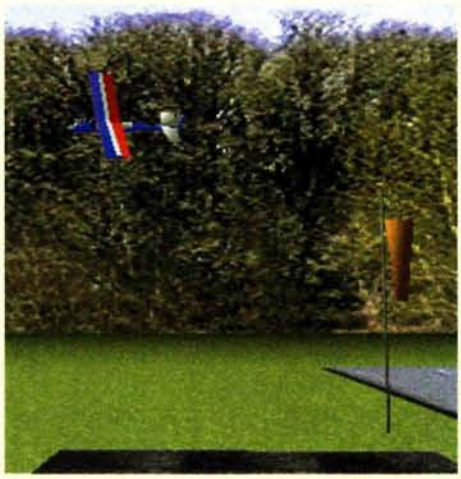
by Bob Hastings

I enjoy and respect all facets of RC flying, but I was raised to be—and at heart, will always remain—a fun-flier. When it was my chance to "take the box," I chose the Extra Special from the easily navigated menus. *RealFlight Deluxe*'s replication of the model is stunningly accurate. I'm not just referring to the visual experience, but the overall feel of the model is right there, too. I did all of the regular "loop/roll/spin/touch-and-go" maneuvers and became completely immersed in my

time at the virtual flying field. If you want to try a bigger prop or less pitch, or to move the CG, these "pit tasks" can be finessed onscreen. How about a different engine, faster servo transit, or less wind? Hundreds of airframe, atmosphere and engine parameters are available for you to tweak. It's evident that *RealFlight Deluxe* was designed with significant input from RC modelers. This sim is a great way to try new maneuvers, experiment with setups and learn new disciplines. *RealFlight Deluxe* is as close to RC piloting as you'll get without using glue.

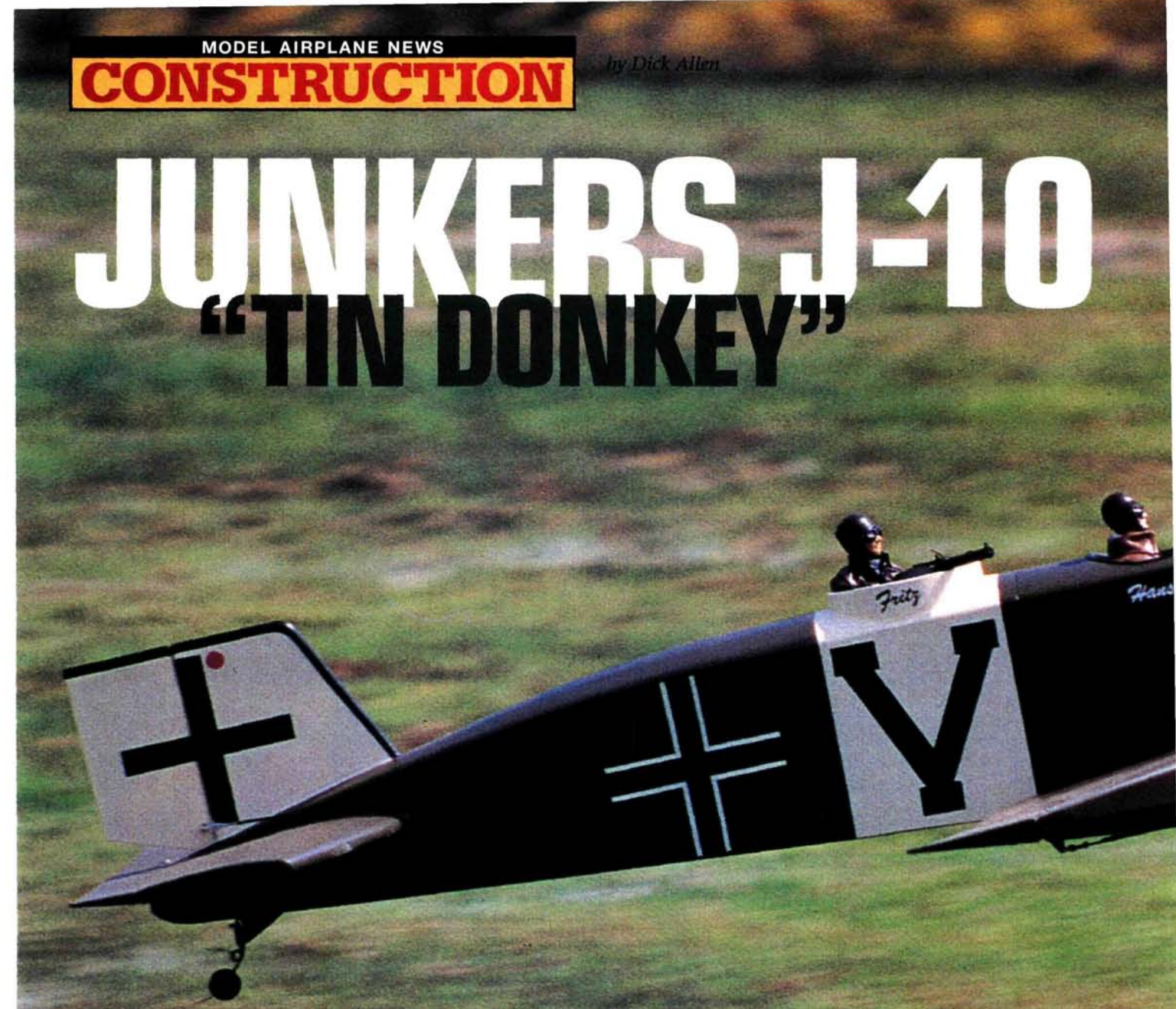
that someone who can serve as an instructor sits with you while you are learning. Although many aspects of the physics are realistic, your trainer plane will be able to pull off hard turns and high-level aerobatics that would break a real trainer.

***RealFlight Deluxe* could easily become an invaluable training tool for fliers everywhere. Novices can learn how to fly, and experienced pilots can experiment with aerobatics, both without endangering a model. You can also test numerous Great Planes kits before buying them, and you can even decide whether a helicopter might be in your future.**



by Dick Allen

JUNKERS J-10 "TIN DONKEY"



Once RC modelers have mastered takeoffs and landings, there's a nearly universal urge to build a scale aircraft; this 1/5-scale Junkers J-10 is intended to satisfy that urge—safely.

The Tin Donkey is an honest airplane that's fun to fly. It doesn't have any bad habits, and it's docile and rugged enough even for those who have built and flown only a few RC planes. At 17 pounds, it has a very light wing loading, and any 35- to 42cc gas engine will give it a spirited performance.

Its square lines lend themselves to quick, accurate construction, and its thick wing and stab airfoil sections give it slow, stable landing speeds and excellent slow-flight characteristics. As a bonus, it's IMAA-legal and qualifies for the Rhinebeck, NY, WW I Jamboree and all World Miniature Warbird Association (WMWA) events. Because it's a fun-scale design, however, if you plan to fly this model in a sport-scale event, you'd better add a corrugated covering, raised seams and rivet detail.

SPECIFICATIONS

Model: Junkers J-10 Tin Donkey

Type: 1/5-scale WW I monoplane

Wingspan: 87 in.

Wing area: 1,547 sq. in.

Weight: 17 lb.

Wing loading: 25.4 oz./sq. ft.

Length: 63 in.

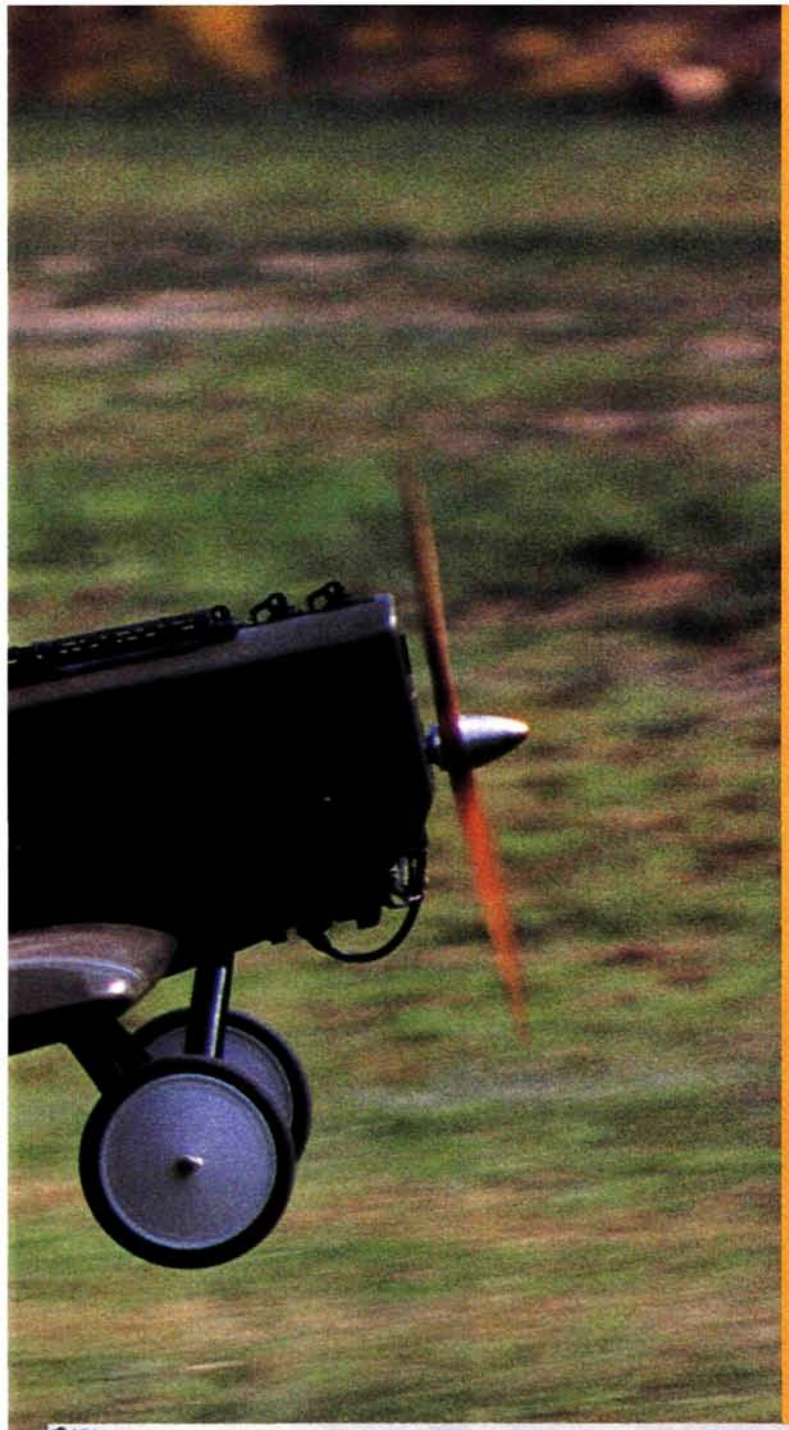
Engine req'd: 35 to 42cc gas

Engine used: Cheetah 42

Radio req'd: 4-channel (rudder, elevator, aileron, throttle)

Comments: designed by Dick Allen, the Junkers J-10 Tin Donkey is an IMAA-legal, 1/5-scale German WW I monoplane that's easy to build and fly, very strong and relatively light. Construction is of typical balsa and plywood with plug-in wing panels.

An easy-to-fly, giant-scale WW I monoplane



PHOTOS BY DICK ALLEN & JERRY SMITH

CONSTRUCTION

The large, boxy fuselage has lots of room for RC equipment: note how it has all been mounted well forward. I positioned the fuel tank slightly to the right so I'd be able to install the throttle servo forward on the left side. The long, removable upper cowl/hatch allows easy engine, tank and radio access (this is a *really* user-friendly airplane!).

Start by building the two sides—a right side and a left side. To curve the front of each side, laminate the ¼-inch balsa sheet to the inside of 1/16-inch aircraft plywood; I use 12-minute epoxy for this. You must build the curve in when you do the laminating, since you won't be able to bend the sides once you've glued the parts together. To further ease the curving process, you may have to cut vertical slots partway through the ¼-inch balsa or use two layers of ⅛-inch balsa.

Complete each side by adding the 5/16-inch-square balsa framework. Since it curves downward, the front of the left side (forward of F-2) will have to project over the left side of your workbench while you do this. Now use an R-1 wing rib to position the wing tube and alignment-dowel holes accurately in the forward fuselage. First cut the holes in one side, and then use that side as a pattern for the second side.

Join the sides over the top view, and cut the 5/16-inch-square cross-pieces to fit. Add the three top diagonals and the four bottom ones, the top formers and the top spars. Note that F-1 is made of two layers of 3/16-inch plywood. F1 is screwed and glued to the two shaped, ⅜-inch-square basswood cover pieces, as are the sides.

The firewall (F-2) is made of two pieces of ¼-inch aircraft plywood laminated together. The bottom is covered with medium-weight, 3/32-inch-thick, cross-grain balsa from F-2 to station 6.

Drill three drain holes in the fuselage bottom forward of the firewall and two holes in the rear of the tank compartment to let oil and spilled fuel drain out, then carefully fuelproof the inside of the tank compartment and the area in front of the firewall with a coat of epoxy.

The rear turtle deck is a compound curve and is easier to glue into place if it is first soaked in water for 20 minutes. Hold it in place with rubber bands and allow it to dry overnight. When it's dry, remove it from the fuselage and cut out a slot for the fin.

Before you make the cockpit cutouts, glue the top 3/32-inch balsa sheet into place. The balsa ring that surrounds the rear cockpit is first formed by wrapping two layers of 3/32-inch balsa sheet around a 5.8-inch-diameter can. Make the ring 1 inch high and with the balsa's grain vertical. To fit the ring on the fuselage, slip it halfway off the end of the can and tape it into place on the can; then tape a sheet of sandpaper to the top of the fuselage. Rub the balsa ring over the sandpaper until it conforms to the fuselage shape. Cut out the rear cockpit hole after you've glued the ring into position.

The removable cowl is made mostly of balsa, but formers C-1 and C-2 are plywood. C-1 is made of two laminated pieces of 3/16-inch-thick plywood. To simulate an air-cooling opening, cut a rectangular hole in the outside fuselage side layer only. I hold the cowl in place with four, recessed, 6-32 Allen-head capscrews threaded into ¼-inch plywood. The cowl is initially built as shown on the fuselage plans; scale details (engine cylinders and machine gun) are added later.

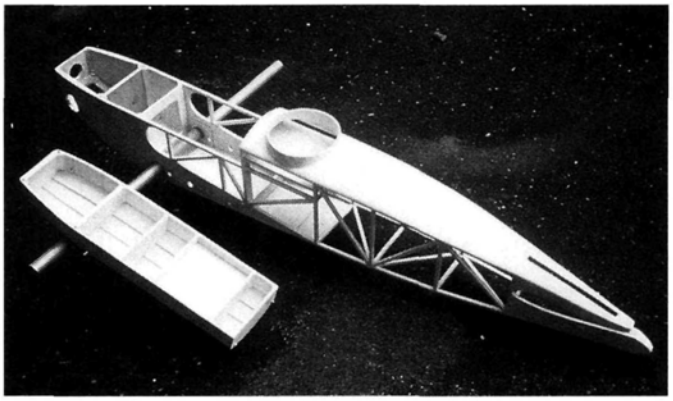
FLIGHT PERFORMANCE

If this is your first low-wing plane, it would be prudent to have your local expert take off and trim it for you. My J-10 required only a slight adjustment to the aileron and elevator trims.

• TAKEOFF

For the first few feet of the takeoff run, I use full up-elevator to hold down the tailwheel. If you have the correct right thrust built in, the model will track straight into the wind. I then neutralize the elevator and let the model gain speed. After about 50 to 75 feet, slight up-elevator is all that's needed for liftoff.

To check your model's right thrust, trim it for straight and level hands-off flight at full power. Fly the model directly overhead at full power. As it goes straight away from you, quickly chop the throttle to a low idle. If it turns to the right, it needs more right thrust.



The J-10's fuselage is basically a box made of stick wood—a design that's very strong and relatively light for a model of this size.

Finally, slip two 5/16-inch-square spars inside the fuselage, then clamp and glue them to the inside bottom corners of the framework box. Use a liberal amount of glue to attach them to all the fuselage cross-members and to the bottom spars (where the corners touch) along the entire length of the fuselage from station 6 to the rear. Now glue two 1/4-inch-square spars to the inside top corners from station 6 to the stabilizer opening. This greatly increases the strength of the fuselage but adds very little weight.

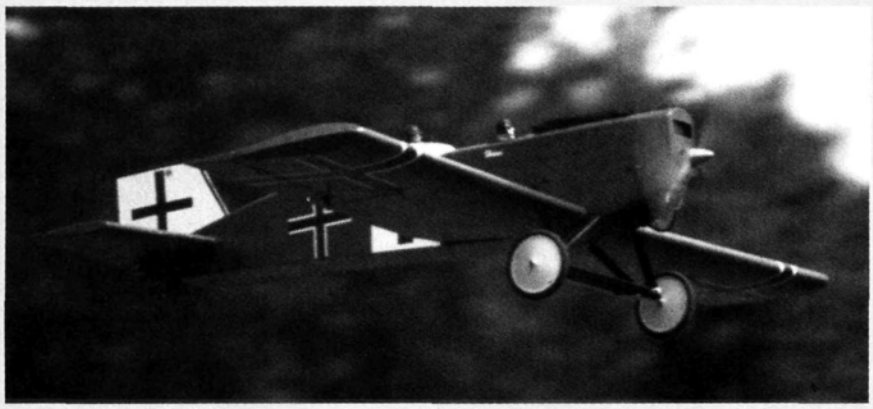
Because the model has such a short nose moment, right engine thrust must be set at 2.5 degrees. I power my J-10 with a Cheetah* 42 engine that's more than adequate for it.

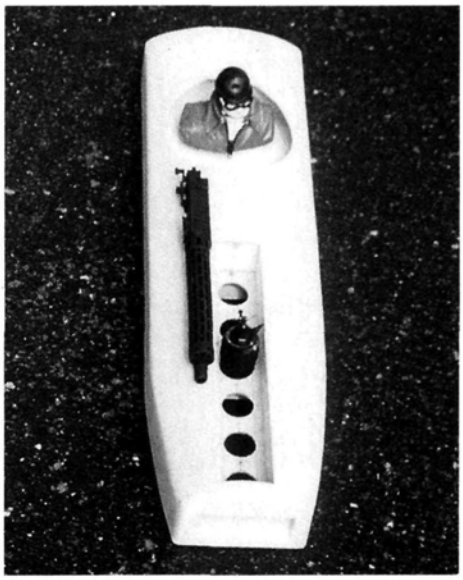
WING

Build the wing panels on a flat surface. First, lay the lower 3/32-inch-thick trailing-edge (TE) sheet on the plan, and epoxy the bottom rear balsa spars to it. Use several ribs to get the spacing right, then glue the ribs to the lower sheet and to the spars, and use weights to hold them down.

The ailerons are built into each wing panel and cut out later. Glue in all the front and rear spars on top of the ribs and glue the diagonal braces to the aileron and wing root. Glue in the plywood plates for the aileron horn and the 3/8-inch-diameter antirotation dowels. Before gluing on the rear top 3/32-inch sheet, make a saw cut from the TE to within 3/8 inch of its front edge at the aileron break near rib 7. Note that since the wing is built on a flat surface, washout is automatically built in by the sweptback ailerons. Glue on the shaped 1/4-inch-thick inner leading-edge (LE) sheet and then the top LE sheet.

Now, to provide clearance for the aileron washout, turn the wing over and let the TE hang over the edge of your workbench. Glue on the bottom front spars, then, with the center of the panel





The main fuselage hatch is made of balsa and ply and holds the pilot figures, dummy engine cylinders and machine gun.

• LANDINGS

On landing, the J-10 isn't demanding. Owing to its thick airfoil and bulky fuselage, its landing approach can be fairly steep and it won't gain excessive speed. Use throttle to control your descent and use elevator for airspeed control. Hold the model off until you lose all excess airspeed, and flare just as you touch down. Its slow-flight characteristics are very good.

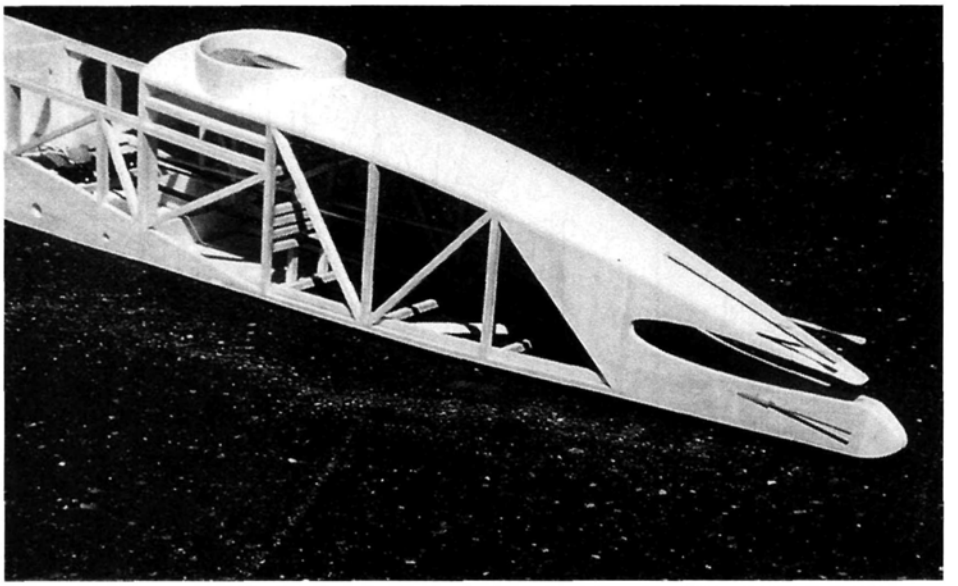
• AEROBATICS

Inside and outside loops aren't a problem. The small rudder is surprisingly effective, and the J-10 will do very good stall turns without needing aileron correction. Rolls and inverted flight are docile.

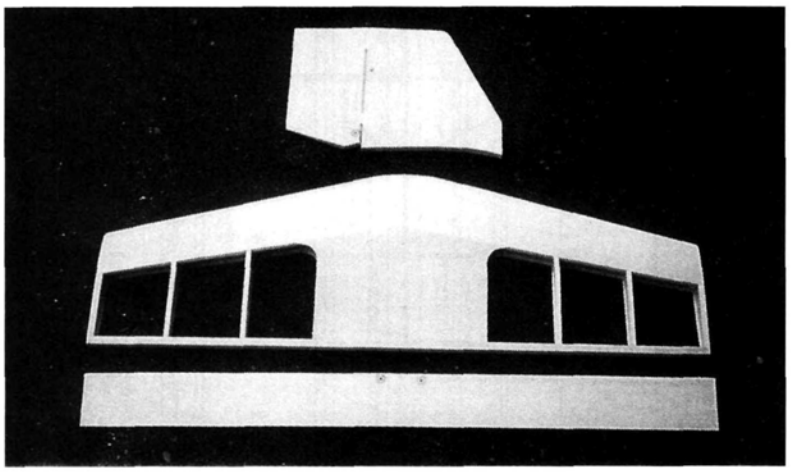
If you set up the model as recommended, it will not spin or snap roll. I have to force mine into spins and snaps. Increased control throws and a slightly aft CG will make snaps and spins easier, but the model is not designed for hard aerobatics.

I have flown in some nasty crosswinds, and while some of the WW II fighters and WW I biplanes were nosing over, ground looping, or wiping off their landing gears, the J-10 did touch-and-go's with ease. You won't have to baby it.

Viel Glück!



The curved top rear of the fuselage is planked with balsa. The raised rear cockpit ring is added after the rear planking has been installed.



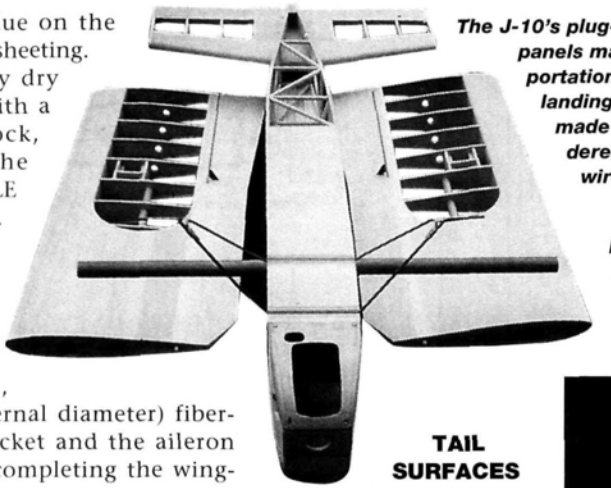
The horizontal stab is built up and has an airfoil cross-section. The fin and rudder are made of balsa sheet.

weighted down, glue on the bottom 3/32-inch LE sheeting.

Let the assembly dry overnight, then, with a long sanding block, sand the LE of the sheeting and inner LE strip flat and true. Glue on the outer 1/4-inch sheet LE, and finish-sand the wing panel. Install the 1/4-inch ply plate on rib 1, the 1.25-inch (internal diameter) fiberglass wing-tube socket and the aileron cable tube before completing the wing-panel sheeting.

Cut out and finish the ailerons after the wingtip has been added. Be careful when hinging the ailerons; if you reverse them, you will end up with washin (tips down) instead of washout!

The bomb-drop mechanism is optional—but fun! I use a servo-operated cable to pull the spring-loaded release pin to drop the "bomb."



The J-10's plug-in wing panels make transportation easy. The landing gear is made of soldered music-wire pieces.

Below: the completed model awaits its covering.

TAIL SURFACES

Since the J-10 has a particularly short nose and a long tail-moment arm, you *must* keep the tail light. The horizontal tail is built like a simple wing. Apply the sheeting to the framework while it rests on the flat workbench. Cut the elevator halves off after you've assembled it.

Make the rudder out of the lightest piece of 1/2-inch balsa sheet you can find. Make the fin of a medium-light 5/16-inch-square balsa framework, and cover it with light, 3/32-inch balsa sheet.

If you want to, you may hinge the elevator/stab now, but do not hinge the fin/rudder until you've attached the stab and fin to the fuselage and installed the steerable tailwheel. Use heavy-duty, pinned, *nylon* hinges—*not* CA hinges. I like a removable rudder; I pass a long piece of music wire through all the nylon hinges.

Slide on the wing panels to act as a sighting for reference, then glue the stab and fin to the fuselage. The elevator pushrods should be straight—no dog-leg bends. I use a pull/pull rudder system made from Sullivan's* black carbon-fiber Nyrods.

LANDING GEAR

The landing gear is 7/32-inch-diameter music wire, and when installed, the axles should be directly under the wing's LE. To assemble it, sand the areas to be soldered and wrap the gear legs together with tinned, no. 22 copper wire.

Install the gear on the airplane, and solder the legs together with silver solder or brazing rod. Remove the gear from the plane and remove the flux with a solvent.

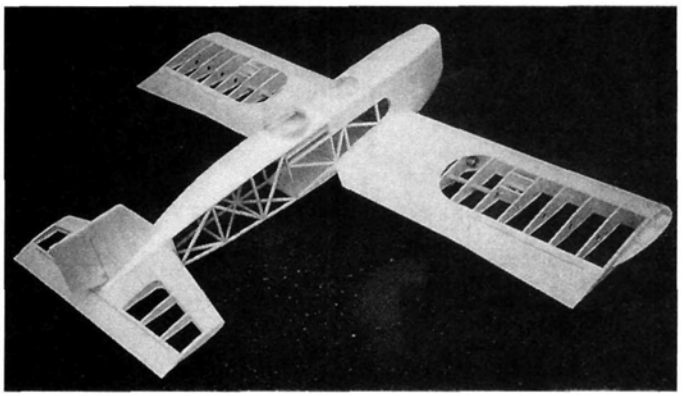
The spreader bar between the wheels is both scale-like and functional. It prevents the wheels from bowing outward on hard landings.

My tailwheel assembly is 3/32-inch music wire. I coiled the wire three times, inserted the upper end up through the fuselage and stab and then bent it back 90 degrees to insert it into the rudder's LE.

FINISHING TOUCHES

World War I airplanes just don't look right without pilot figures. My flight crew (Hans and Fritz) are 1/5-scale WW I figures from Pilots by Diane*. They're light, well-made and realistic, and they're held in the cockpits by Velcro®-brand fastener, as is the rear machine gun.

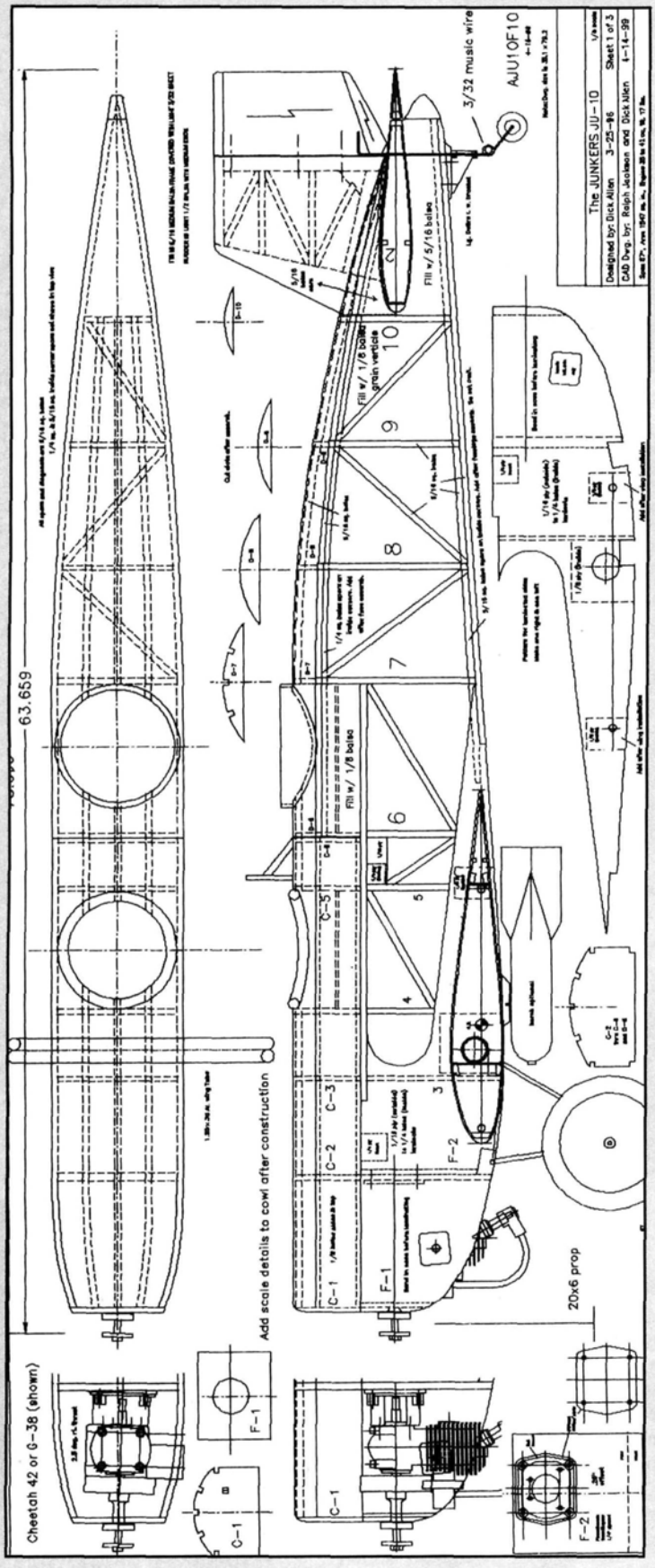
I covered the airplane with flat, olive

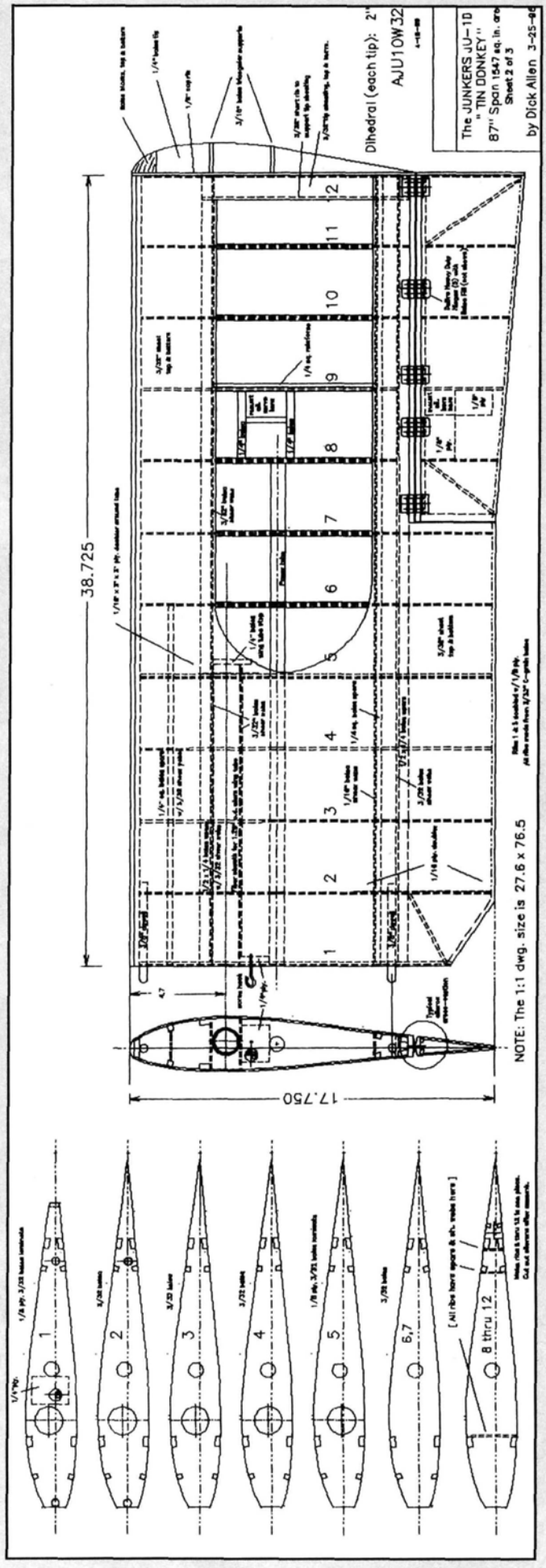


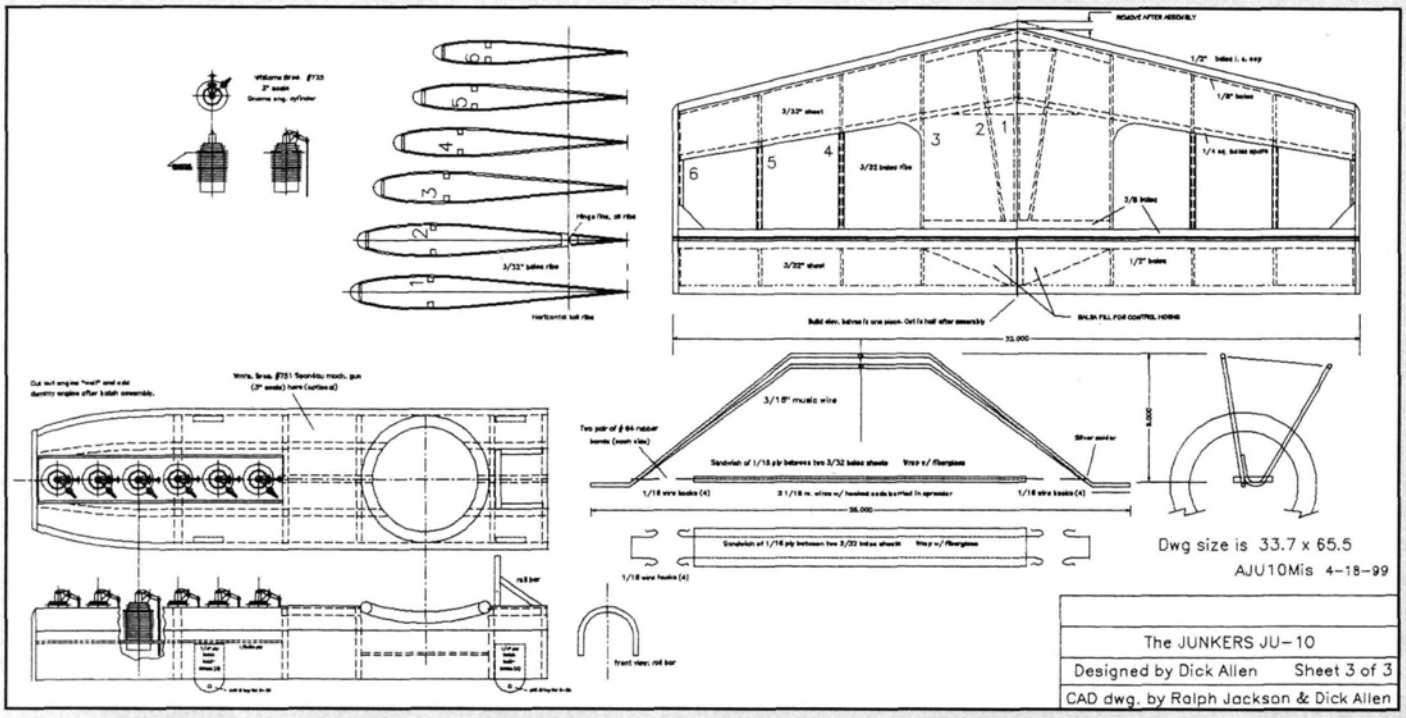
TO ORDER THE FULL-SIZE PLANS, FSP0100A, SEE PAGE 192.

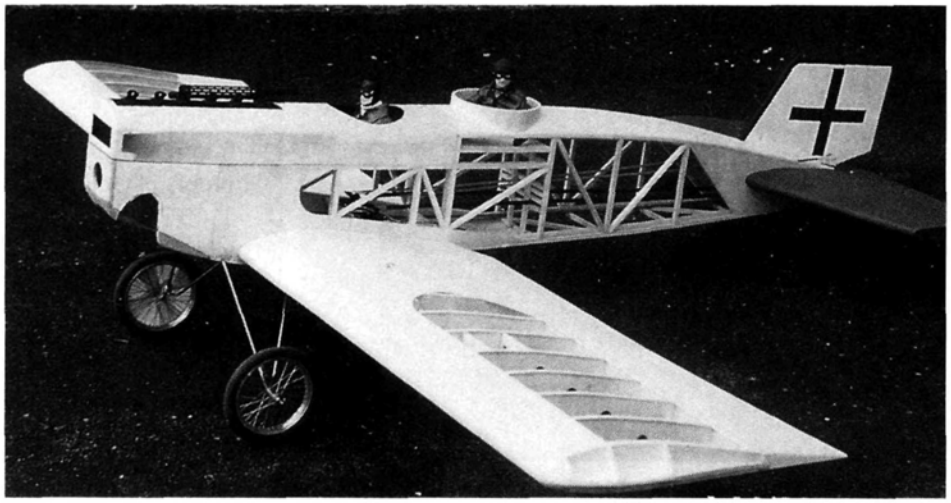
Junkers J-10 Tin Donkey

Designed by Dick Allen, this strong, relatively light Junkers J-10 Tin Donkey is an IMAA-legal, 1/6-scale German WW I monoplane. Construction is of typical balsa and ply, and the model features plug-in wing panels and is easy to build and fly. WS: 87 in.; L: 63 in.; engine: 35 to 42cc gas; 3 sheets; LD 2. **$24.95**









The finished tail surfaces are in place, and the control linkages have been installed. It is much easier to install the pushrods and radio gear before you cover the fuselage.

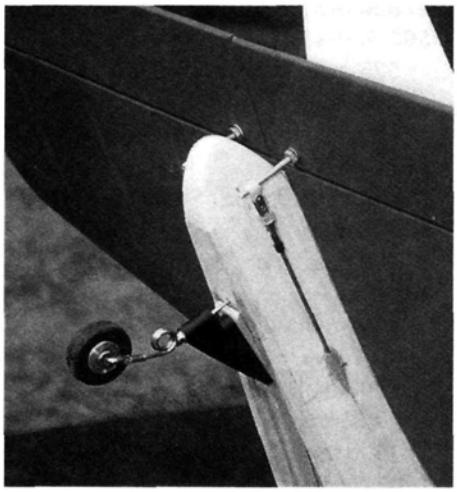
Removing the main fuselage hatch allows unrestricted access to the model's interior. It's easy to make engine adjustments.

drab Worldtex* fabric and used the same material for the insignia and markings, which I ironed into place. I used a permanent-ink felt-tip pen to add the "stitching" and panel lines, then I brushed on two coats of flat clear polyurethane varnish for a durable finish that isn't affected by gasoline.

FINAL SETUP

Move the battery pack around to balance the model at the CG shown on the plans. My prototype didn't require additional weight to balance properly. The battery pack, receiver and fuel tank are held in place with Velcro®.

To check the lateral balance, pick the plane up by its engine shaft and tail cone, and if you need to, add weight—wood screws, pennies, etc.—to the lighter wingtip.



This close-up of the tail shows the divided, two-piece elevator and the twin elevator control horns. Note the steerable tailwheel.

For the first flight, start with these control throws:

- Elevator—⅜ inch up and down.
- Rudder—1¼ inches right and left.
- Ailerons—1 inch up and down.

Before I end, I'll thank a good friend, superb builder and ol' flying buddy (OFB), Bill Underkofler, for framing up my J-10. Another OFB, Ralph Jackson, helped me with the CAD drawings, and his patience is much appreciated. Good flying!

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.* ✈

SCALE REFERENCES

- "The Junkers Monoplanes" —Profile Publications no. 187.
- "Junkers' Tin Donkeys" —Air Classics, May 1979.
- "Junkers J-10 'Tin Donkey' " by Dick Allen—Model Builder, June 1980.

SR

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1100 mah, 4.4 oz., $36.95

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1400 mah, 5.2 oz., $44.95

1600 Series
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2800 mah, 10 oz., $58.95

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Wouldn't you like an 1100 mah pack for your Futaba, JR or Airtronics transmitter? No problem! Our new 1100 Series Tx pack will give you just that.

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We also make packs for ***Kraft***, as well as every other, transmitter ever made.

As we said, our packs do cost a little more, but what is your aircraft worth? It's been almost 20 years since we started saying, "The best radio gear is no better than its batteries," and it's as true today as it was then. Isn't your aircraft priceless and worth a few extra dollars for a ***good*** battery pack?

If you have any questions that we can help you with, visit our web site **www.srbatteries.com** or give us a call at **516-286-0079** and we'll be glad to help.

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SPECIFICATIONS:

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MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

by Dave Garwood

Throw it or tow it!

Have you always wanted to try scale sailplane aero-towing but hesitated because of the high cost of the traditional fiberglass kits, or because you were afraid of damaging your beautiful 'glass "slipper"? If so, your worries are over. Dave Sanders of Dave's Aircraft Works (DAW)* has designed and released a large, bounceable scale sailplane made from expanded polypropylene (EPP) foam—that tough stuff that gave us full-contact foamie flyers. This wonder foam can take hits and immediately return to its original shape and strength, thereby removing many of the worries of flying a large scale sailplane.

Sanders has done a first-rate job of designing and producing a kit that builds quickly into a big plane; the kit removes much of the fear, uncertainty and doubt (aka "the FUD factor") from building and flying a large-scale sailplane. The Schleicher Ka6E is an aero-tow trainer, a worry-free sport sailplane and a reputation-builder on the slope.

Dave's Aircraft Works SCHLEICHER Ka6E Scale glider

BY DAVE GARWOOD AND RICH LOUD

SPECIFICATIONS

Model: Ka6E

Manufacturer: Dave's Aircraft Works

Type: scale aero-tow trainer; sport thermal and slope sailplane

Wingspan: 117 in. (open class)

Length: 54 in.

Weight: 85 to 90 oz. (manual), 87 oz. (as built)

Wing area: 906 sq. in.

Wing loading: 13.83 oz./sq. ft. (as built)

Airfoil: 11 percent S-3021 root, symmetrical tip

Engine req'd: none

Radio req'd: 4-, 6-, or 7-channel, depending on flight functions desired

List price: $189.95, plus shipping

Features: good for moderate to expert builders; EPP foam, hardware and parts included; design can be easily expanded.

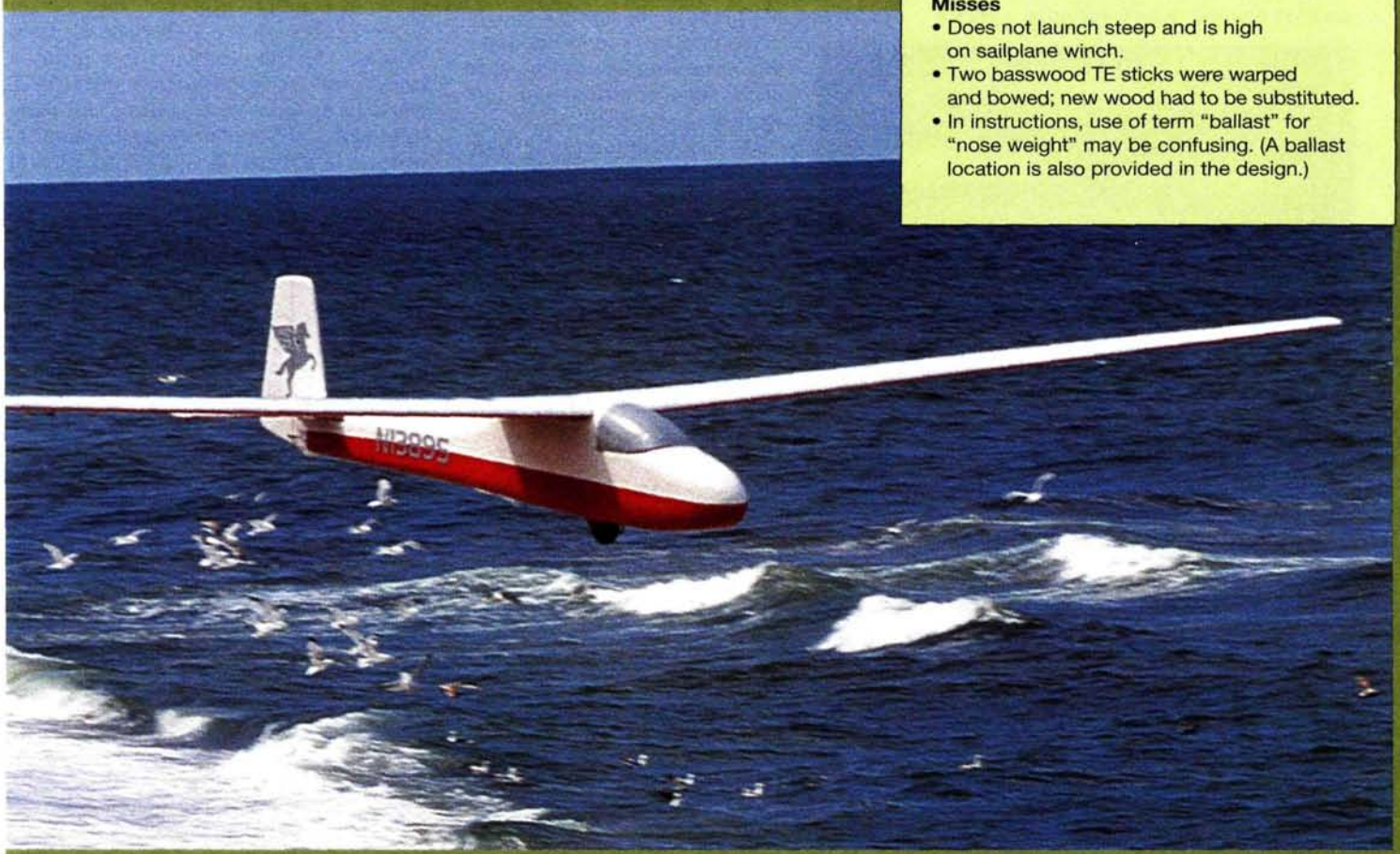
Comments: a remarkable breakthrough "rubber" sailplane that fills a need for an aero-tow trainer, serves admirably as a sport thermal-duration plane and is a delight to fly in slope lift.

Hits

- Largest EPP-foam sailplane in production in the world.
- Flight performance exceeds expectations.
- Exceptional, high-quality shaped-foam components.
- Complete, high-quality hardware and wood.
- Excellent, thorough instructions.

Misses

- Does not launch steep and is high on sailplane winch.
- Two basswood TE sticks were warped and bowed; new wood had to be substituted.
- In instructions, use of term "ballast" for "nose weight" may be confusing. (A ballast location is also provided in the design.)



FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

The Ka6E rides high behind a towplane and easily keeps the tow line taut. It aero-tows as well as any large sailplane I've seen and much better than small sailplanes. Winch launch gives you a shallow launch angle because of the forward location of the tow hook. Dropping flaps on the launch does not increase the launch angle, but slope launch is completely normal; just heave it out into lift. The plane lands predictably, and just as with landing any big, fast sailplane, you must fly the plane all the way down. The long landing rollout on the wheel brings a smile to my face every time.

• LOW-SPEED PERFORMANCE

With a wing loading of nearly 14 ounces per square foot, the Ka6E is not happy being flown slowly. Like many scale sailplanes, it has a sharp and deep forward stall, which you'll want to avoid by keeping the speed up. The symmetrical-section tip design works for me, as I never noticed a tip stall, or perhaps more properly stated, a single-wing stall.

• HIGH-SPEED PERFORMANCE

It's amazing how well this plane moves out and how quickly it covers ground; the pudgy fuselage seems to make no difference. It is possible to go too fast with the Ka6E; the first sign of trouble is rudder flutter. With speed, controls are crisp, and the plane grooves around the sky.

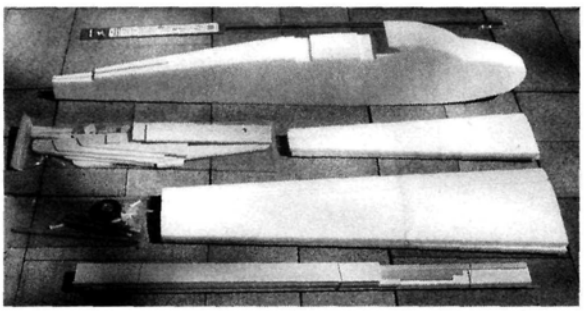
• AEROBATICS

Large or small inside loops are easy. Inverted flight requires massive amounts of forward stick pressure, but the plane will climb in thermals while inverted. It will perform sloppy spins, but its stability fights this maneuver, and the spins look more like spiral dives. It's a natural for point rolls and Cuban-8s, and it carries enough energy to easily complete outside loops.

KIT CONTENTS

The chunky fuselage is immaculately cut and has a pre-installed balsa tail stiffener; the four wing-cores are cleanly hot-wire cut to receive basswood spars. I was truly impressed by the quality and quantity of the kit-supplied wood and the number of brand-name parts.

A key item in the Ka6E kit is the detailed manual, which includes a photo-graph of the completed plane, 10 pages of densely packed text, a parts list and 11 clear drawings. This was the first EPP foam kit I've built, and the instruction manual included everything I needed to know to build the plane. To complete the kit, all you'll need are some specialty adhesives, 50 yards of 2-inch filament strapping tape, heat-shrink covering and a radio set.



The kit contains the fuselage, the inner and outer wing panels, a bag of wooden parts, a hardware bag, a bundle of long wood pieces and some 48-inch control rods.

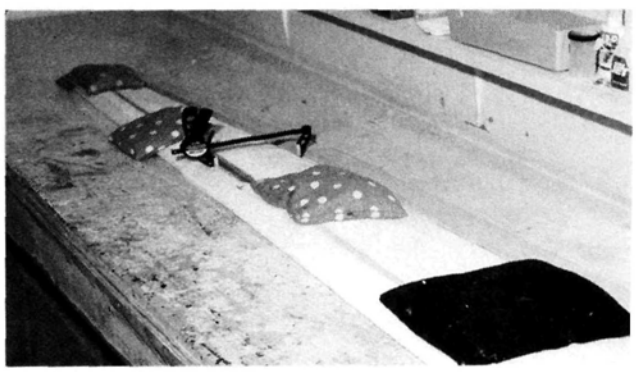
RADIO SELECTION

To save delays, you'll want to select and purchase your radio gear before you begin construction because the electronics are installed in an EPP plane during the building process.

The Ka6E can be flown as a slope plane with a simple 4-channel radio by connecting the two aileron servos with a Y-cable and omitting the aero-tow release mechanism and its servo. If you want flaps to increase landing accuracy, they can be rigged with a Y-cable and controlled from the throttle stick. To control the Ka6E as intended, however, you'll need a 6-channel radio. A computer transmitter is useful, as it allows you to fine-tune the control-surface throws and set up aileron differential and spoilerons, if desired.

In my case, once I began contemplating the radio gear installation, I wondered about adding flaps. While the prototype aircraft does not have flaps, I figured that they would help in making precise landings on tree-covered slopes. With the designer's approval, I fitted the inner wing-panel trailing-edge (TE) stock with flaps, and I'm happy I did. Flaps increase the performance and flexibility of the Ka6E when it's flown as a sport plane. This decision required me to fit a 9-channel receiver, setting up the plane for standard thermal-duration competition and controlling the tow release with a toggle switch on my JR* 388.

I installed three JR 517 ball-bearing, standard-size servos in the fuselage for rudder, elevator and tow release, and four JR 341 tough-guy microservos in the wing for ailerons and flaps. I also used a JR NER-529X 9-channel receiver and a JR 4-cell, 1500mAh battery pack. In addition, I needed to use JR 36-inch servo extension cables and four, 12-inch servo extension cables to properly connect all of my servos.



The author installed the wing spars and sub-trailing edges using Borden's Probond glue, which gives a half hour or more of working time. Before it cures, clean-up is easy with mineral spirits; after it has cured, the excess must be removed with a knife or by grinding.

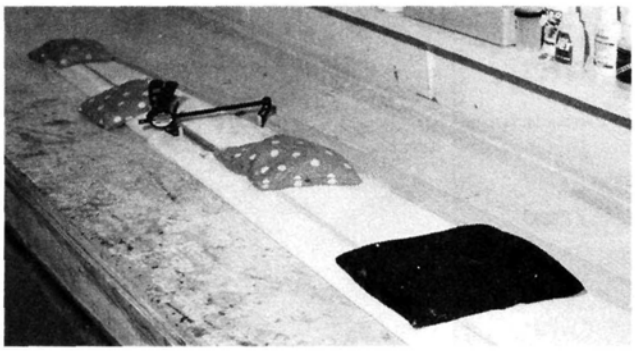
CONSTRUCTION

The instructions are so complete, thorough and accurate that a blow-by-blow description of construction is not needed here. Let me instead highlight the differences between EPP and balsa or fiberglass construction.

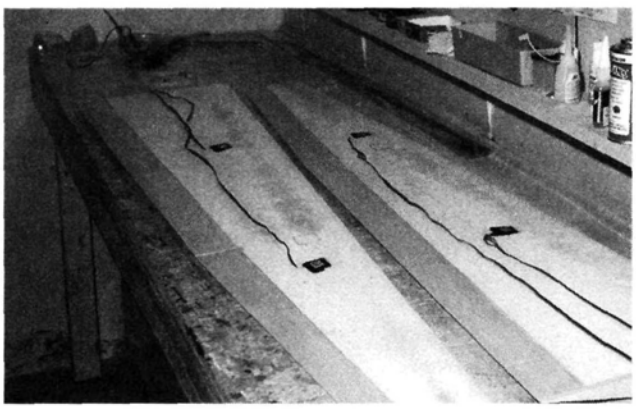
Many adhesives do not stick to EPP, so you have to do most construction with "Goop" glue and epoxy. Goop sets up pretty fast for my taste, so with the designer's concurrence, I used Borden's Probond glue; it allows a longer working time to install wing spars and sub-trailing edges to the inner and outer wing panels. Before it has cured, it's easily cleaned up with mineral spirits, and during curing, it expands to fill small spaces. But afterward, excess glue must be removed with a knife or by grinding.

Shape the wing leading edges (LEs), ailerons and flaps with sandpaper, and when you install the wing-rod joiner receiver tubes, glue the overlapping spars with epoxy. The next morning, install a small piece of wood to join the sub-TE wood parts, also with epoxy. The wing halves are heavy and wobbly; the secret to stiffness in EPP planes is the outer shell of filament packing tape. I used 3M Premium Strapping Tape, claimed by 3M to be stickiest. Use a coating of 3M 77 spray or another contact cement to make the tape stick.

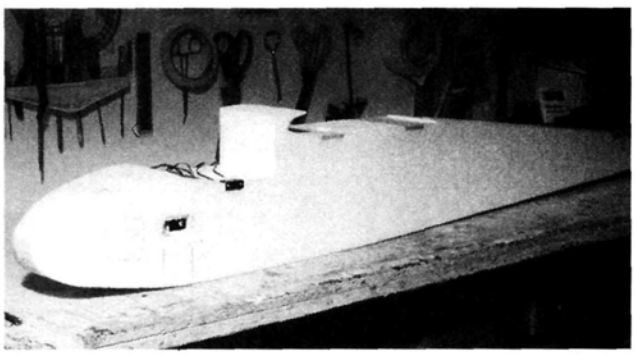
Install the servos by cutting pockets out of the foam that have been sized correctly for a snug fit. I secured mine with GE Silicone Household Adhesive. Cut slots and bury the servo wires in them before you apply the strapping tape.



After you've installed the spars and wing-joiner receiver tubes, join the inner and outer wing panels with epoxy. Sandbags will help keep the panels flat, and a clamp will keep the inner and outer spars in close contact.



Install the servos with spliced cable extensions before you bury them in slits in the wing foam. Tack-glue the ailerons and flaps into place for final shaping with a razor plane and sanding blocks.



The fuselage is shown here with the wood parts and some of the radio components installed. If you fit the servos and other radio parts before you shape the fuselage, measuring and alignment will be easier.

Interestingly, the wood parts for the fuselage and radio components are installed before the fuselage is shaped. Fitting the servos and other radio parts first helps with measurement and alignment. Place wood parts such as the wing-bolt receiver plates and the landing-gear standards into the precisely cut slots and hold them in place with Goop. Further secure high-stress areas such as the wing mount with strapping tape. After you have installed the radio gear, antenna tube and rear control-surface pushrods, shape the fuselage with a knife and sandpaper.

The tail surfaces are balsa sheet, which is sanded and covered with heat-shrink covering. Glue the fin into the fuselage with Goop after you've covered the fuselage. The horizontal stabilizer is bolted into place, and this makes it removable for easier transportation and storage.

Construction and radio installation took 35 hours. Covering and final radio setup took another eight hours. As suggested by Dave Sanders, I covered the sailplane with Carl Goldberg* Ultracote. After the test flights, guided by computer-generated paper templates, I cut the markings out of Ultracote. Finishing with all Ultracote, including the markings, makes maintenance easy: most repairs are done with a hot covering iron.

No "Field & Bench" review would be complete without including building hints learned along the way, so here are some:

- Spray your 3M 77 adhesive out of doors, leaving the overspray outside; then bring the parts inside to cover.
- Install microservos for aileron control. Although there is enough room to install full-size servos, it would be a tight fit.
- Since you're covering the plane with Ultracote, use Ultracote hinges to add to the plane's flexibility, ease the installation, increase its life and prevent air from flowing between its surfaces.
- If you like a tight fit for your wing and stab, select a 3/16-inch-diameter drill bit instead of the recommended 7/32-inch bit to make those holes.
- Use a sharp blade and new sandpaper on long sanding blocks to shape the wings and fuselage, and you'll find that the EPP will behave a lot like regular white (EPS) foam.
- Mount a copy of the wingtip template drawing from the instructions onto card stock. This makes shaping the tips easier, and you'll be amazed at how accurately the supplied parts match the working drawings.

For my final construction tip, I recommend that you send for the Ka6E photos and 3-view drawings from Bob Banka's Scale Model Research* for ideas for a scale color scheme and to prove how closely—or not, depending on your expectations—this kit matches the prototype.

FLYING THE KA6E

For test flight, I hand-launched the Ka6E over a large, gently rising, grassy slope. What I expected to be a 200-foot-long, up-and-down flight turned into a 2- or 3-minute flight in mixed slope and thermal lift. My first flight immediately showed me that the Ka6E flies well and confirmed that the model's balance point was correct. I also learned that the plane has deep and sudden stall characteristics when it is flown too slowly and that you can easily get snappier roll-control response by mixing flap movement to follow aileron movement.

I have flown the Ka6E at numerous events, as have many others, and it has always flown well. We did discover that the compensation necessary for flap deployment with the elevator is reversed. The Ka6E needs up-elevator rather than down-elevator when flaps are deployed, as is required on most big thermal-duration planes. The result of our initial misunderstanding was an extremely hard landing on the wheel—hard enough to pop off the taped-on canopy. Jaws dropped, and mutterings escaped the mouths of onlookers, many of whom were scale pilots accustomed to flying scale sailplanes valued at $2,000 to $3,000, but the EPP Ka6E showed no damage. We taped the canopy back on and relaunched the sailplane.

You must remember to keep the speed up with this one, just as with many other high-performance sailplanes; when you do this, its performance will surprise you. The DAW Ka6E is a keeper.

Radio and control-rod installation and all of the actual construction are complete. The Ka6E is now ready for shaping and covering.

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.*

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

Nelson Hobby Specialties Axis HVLP Spray System

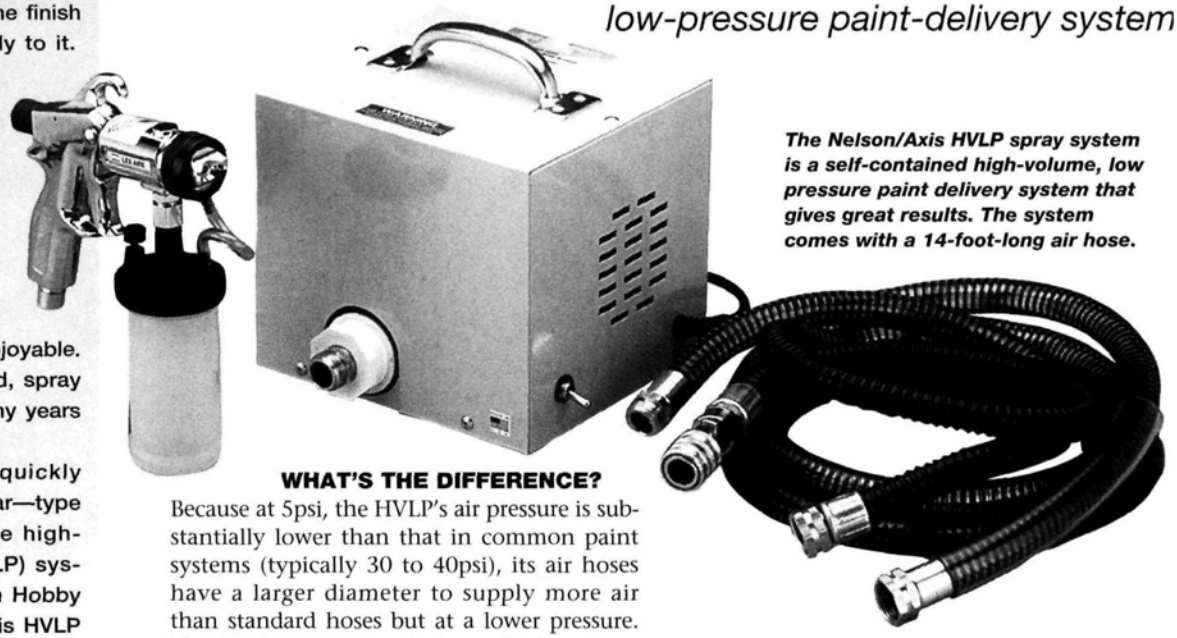
by Gerry Yarrish

A self-contained, high-volume, low-pressure paint-delivery system

OFTEN, ONE OF a modeler's last decisions when building a model airplane is the finish that he will ultimately apply to it. Once you've passed the aerosol spray-can stage of painting, you should seriously consider the type of spray equipment you want to invest in. Good equipment greatly enhances the overall quality of a model's finish and makes the job more enjoyable. Also, if properly maintained, spray equipment will provide many years of service.

The newest—and it's quickly becoming the most popular—type of spray equipment is the high-volume/low-pressure (HVLP) system. Available from Nelson Hobby Specialties*, the Nelson/Axis HVLP self-contained system comes with its own air-delivery turbine; you don't need a separate air compressor. Why should you consider an HVLP system? Read on.

Other HVLP spray guns are available for use with standard air compressors, but they require a secondary, in-line pressure regulator to lower the pressure to approximately 5psi. The Nelson/Axis system, being self-contained, comes with a compact air turbine that delivers the correct air pressure to the HVLP gun. The turbine sounds very much like a vacuum cleaner and is very light and easy to carry.

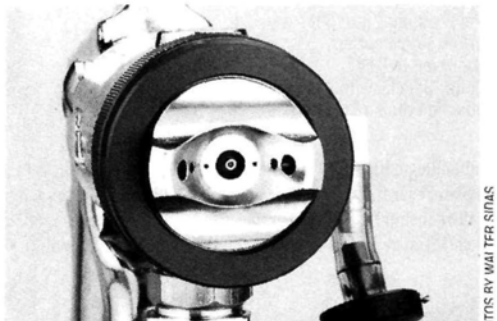


The Nelson/Axis HVLP spray system is a self-contained high-volume, low pressure paint delivery system that gives great results. The system comes with a 14-foot-long air hose.

WHAT'S THE DIFFERENCE?

Because at 5psi, the HVLP's air pressure is substantially lower than that in common paint systems (typically 30 to 40psi), its air hoses have a larger diameter to supply more air than standard hoses but at a lower pressure. That's what HVLP is all about: high volume of air supplied at low pressure.

The air passes constantly through the Nelson/Axis gun, and when the trigger is pulled, pressure is fed into the paint cup to pump the paint up into the gun body. The paint is then atomized and flows out of the gun surrounded by a "cone" of air that helps contain the paint and minimize overspray. Depending on the type of paint you spray, the HVLP gun can save you as much as 40 percent paint when you spray your model.



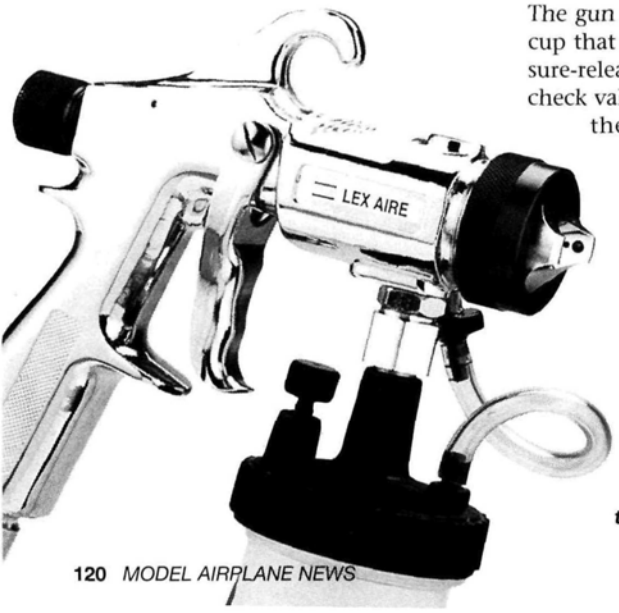
PHOTOS BY WAYNE SUTTON

This close-up of the spray-nozzle assembly shows the adjustable air cap and the outer pattern control ring. Note the check valve in the pressure line going to the paint cup.

THE SPRAY GUN

The Nelson/Axis system spray-gun assembly is a professional grade, Pro-Series SS200 TA. The HVLP gun is designed to gather the feed air within the gun and then send it downstream with as little pressure drop as possible. The gun comes with a plastic, 8-ounce paint cup that screws into place, and it has a pressure-release valve and a pressure fitting and check valve attached to its lid. At the back of the gun is a small, material-control knob that regulates the amount of paint that flows through the gun when the trigger is depressed. A good starting point is to screw the knob in clockwise all the way and then back it out 2½ turns counterclockwise.

At the front are the air cap and nozzle assembly with two adjustments to control the spray's pattern. First, you can adjust the size and atomization of the spray's fan pattern by turning the large, blue pattern-control ring. Turning it in (clockwise) makes the pattern wider, and turning it out makes the pattern narrower. Second, when you turn the three-position air cap horizontal, it produces a vertical fan pattern; in the up and down position, a horizontal pattern is produced; and placed on the diagonal, a circular pattern emerges. In all, the gun is very versatile and should satisfy almost all of any modeler's painting requirements.

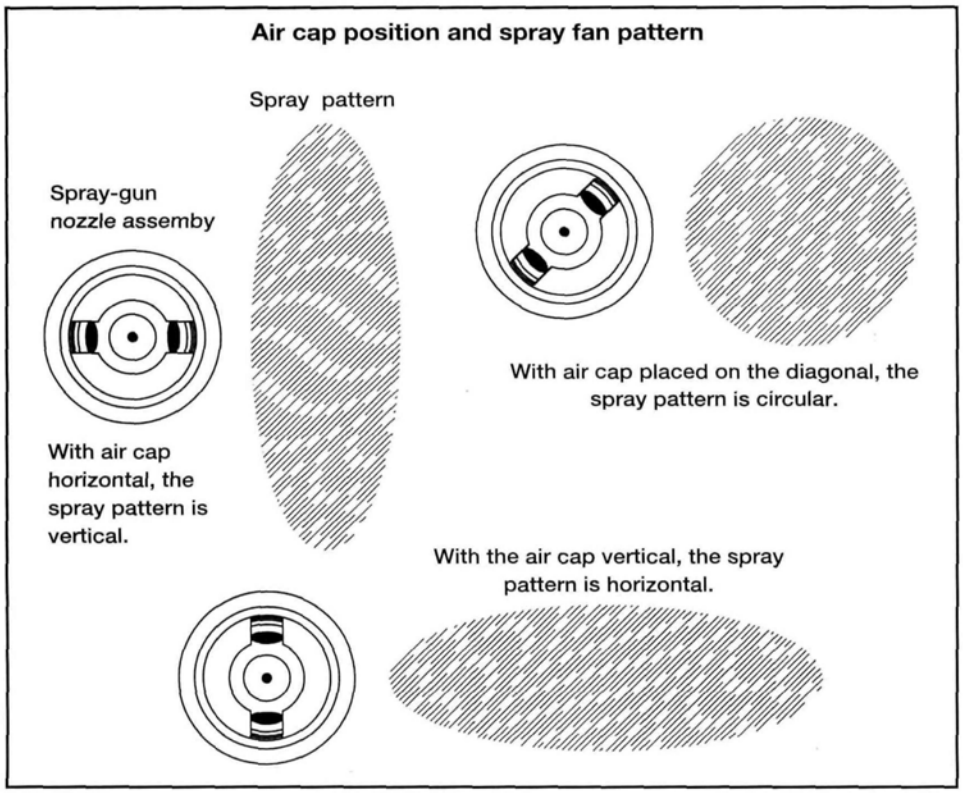


The Pro-Series SS200 TA spray gun system includes a plastic, screw-on paint cup and a quick-disconnect fitting for the air hose.

THE AIR TURBINE

The paint system's 2-stage air turbine supplies air to the gun at a rate of 97 cubic feet per minute (cfm) at about 4psi. The turbine is housed in a small, easy-to-carry metal box, and the air hose (up to 30 feet long) screws onto a plastic threaded air-outlet fitting.

At the end of the air hose are a shut-off



SPECIFICATIONS

Model: Nelson/Axis SS100 Spray System

Distributor: Nelson Hobby Specialties

Type: self-contained, high-volume/ low-pressure

Air delivery: 97cfm at 4psi

Turbine type/rpm: 2-stage/20,000

Power source: 120 volts at 7 amps

Spray gun: Pro Series SS200 TA with 8-ounce paint cup

Price: $695.95

Comments: this professional-grade system is ideal for most model airplane painting. It's versatile and easy to use. The self-contained system does not require a separate air compressor.

Hits
- High-quality, professional system.
- Uses much less paint than conventional spray systems.
- Greatly reduces overspray.
- Heated air eliminates paint blushing.

Misses
- None

valve and a quick-disconnect fitting. The shut-off valve also controls the amount of air pressure that enters the gun. To reduce overspray, keep the air pressure to the gun as low as possible while still supplying sufficient pressure to properly atomize the paint. Depending on how thick your paint is, adjust this valve for the best paint coverage.

USING THE SYSTEM

Make sure you work in a well-ventilated area, placing the turbine as far away from your model as you can to ensure that the air filter remains as clean as possible; overspray can clog the filter. Attach the hose to the turbine (hand tight), and then attach the gun to the hose. Make sure the hose does not bend sharply around any corners, as this can cause it to kink and block airflow.

Mix your paint according to its manufacturer's instructions, and fill the paint cup. With an HVLP system, you will spray the paint at a much lower air pressure, so you may need to add 10 to 20 percent more thinner to your paint. I have used F&M Enterprises* Stits Lite paint for some time, and it can be used straight out of the can (after being strained) without further thinning.

Screw the paint cup to the gun, close the lid's pressure-release valve, close the air shut-off valve at the end of the hose, and turn on the turbine. Allow the air to pass through the gun for several moments until the air becomes warm. Now you are ready to paint.

Since the high rpm of the turbine (20,000) warms the air, the paint in the gun is also heated. The heat removes any water vapor from the atomizing air and greatly reduces paint "blushing." The heated paint also dries faster and sticks better to the model.

When you refill the paint cup, you will appreciate the quick-disconnect fitting, as you can remove the gun from the hose without any effort at all. When you have finished painting, shut off the hose's air valve, turn off the turbine, and remove the gun from the air hose. Do not pull the trigger, or the pressurized paint will be pumped out of the nozzle. Before you remove the paint cup from the gun, open the pressure-release valve. This dumps the air pressure and allows you to remove the cup without paint possibly splattering out.

For general painting and applying base coats of paint, the horizontal and vertical spray fan patterns work best when you hold the gun about 8 to 10 inches from the surface. For close-in detail work such as spraying masked-off insignias or doing weathering and streaking, the circular pattern shot from 6 to 8 inches away produces the best results. As with any spray gun, it will take some practice to get the "feel" of the gun. It is always a good idea to test-spray on a white piece of cardboard to check the spray pattern before you shoot the paint onto your model. And as a rule, start with the lightest colors, and apply the darker colors over the lighter.

Clean the cup and gun with the proper paint thinner, and be sure to spray thinner through the gun until all traces of color have been removed.

If you plan to do a lot of painting in your hobby, the Nelson/Axis HVLP advanced spray painting system is a good investment that will provide excellent results for many years. The savings in paint materials and the great control afforded by the gun make it a useful tool for any modeler who likes to paint his models.

Addresses are listed alphabetically in the Index of Manufacturers on page 198.

HVLP PAINTING TIPS

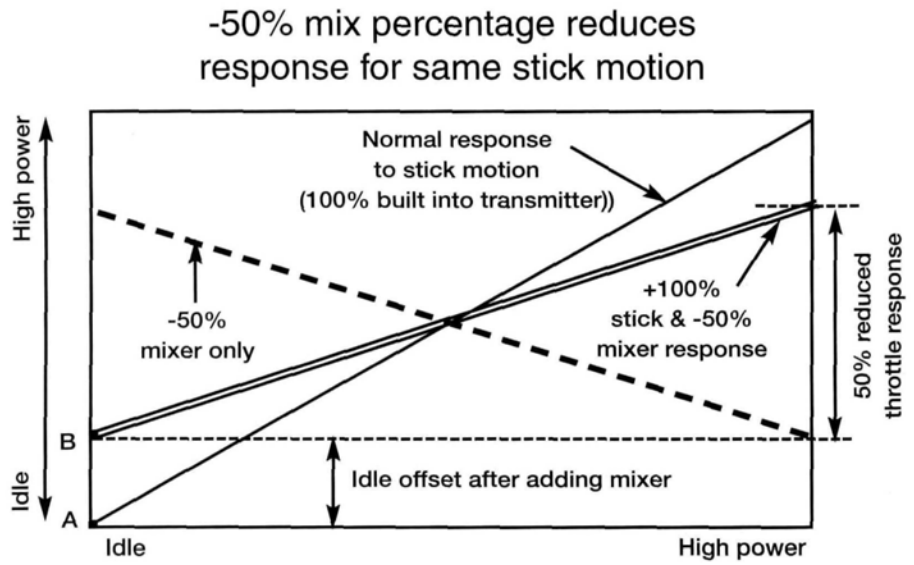
Painting a model with a high-volume, low-pressure spray system is a bit different from a normal air-compressor-driven paint set. Here are some tips to remember.

- Remember to turn the turbine off and to open the pressure-release valve before you open the paint cup.
- Depending on the paint, add 10 to 20 percent more thinner.
- To keep the air filter as clean as possible, keep the turbine away from the spray area.
- Do not run the turbine with the air shut-off valve closed for long periods.
- Use the correct fluid nozzle and needle for the paint you are using (1mm for most paint, and 1.2mm for nitrate and butyrate dope).
- Hold the gun 6 to 8 inches away from the surface to be painted, and adjust the air control so just enough air is used to get good coverage.

Answers to common questions

HERE ARE SOME interesting questions I recently received from readers over the Internet. I suspect that for every person who writes to me, there may be a bunch of others who didn't, so I hope that this is useful to everyone.

Figure 1.



SERVO TRAVEL

"I have the Futaba 6XA as my first computer radio. How do I set up the throttle on my O.S. .52 Surpass? The throw is small on this engine (and on other 4-strokes as well) and I want the servo to travel only so far. I tried several settings in the ATV. I want the throttle stick to make its full travel and have the servo move the proper (small) amount. Right now, idle is at the lower stick setting, but full throttle comes in at only 50 percent travel of the stick! Help me, please!"

Well, it appears you did the right thing setting up servo travels. I'll point out that the mechanical throw can be reduced by moving the throttle pushrod closer to the servo, but I assume that you did that as well. So now we have to think of another way to reduce travel.

Remember, in the August '99 column I explained how to disable a knob whose channel number was being used as the master for mixing? We can use the same idea here to reduce the throttle-servo travel to match the carburetor's. If you recall, we selected both the master and slave channels of a programmable mixer to be the same and chose –100-percent mixing to cancel them out entirely (built-in 100 percent plus the –100 percent equals zero). To reduce throttle travel, we'll use the same technique, but with a little twist.

Our problem is with throttle: 100 percent travel is too much; we need 50 percent, so we have to reduce the travel by 50 percent. So we define a programmable mixer PMIX so that Master = Throttle, Slave = Throttle and the mixing value is –50 percent. Then our travel will be +100 +(–50) = 50, which is exactly what we want. This is illustrated in Figure 1.

When you do this, you'll notice that the engine idle position changes (in Figure 1, it changes from point A to point B because of the added mixer). All you have to do is remove the servo arm and replace it so that the idle is back where it should be. You may need to adjust the PMIX percentage to get just the travel you would like, then reposition the servo arm.

SLOPPY SERVOS

"I have some servos that developed 'slop' in the gears. I know that all servos have a bit of slop even when new, but these used ones definitely have more slop than when they were new. [Note: "slop" is a description of what happens when you can rotate the servo arm a little without feeling much resistance. It usually is not good, leading to neutrals that are not consistent, and in extreme cases, it can lead to control-surface flutter and catastrophic failure.] *Incidentally, the servos I am writing about have all had aftermarket ball-bearing case tops installed, so I think it is probably not the output shaft moving in the case. What can I do? Should I just replace the gears? Some of these are four or five years old and work perfectly.*

To remove slop from servos, there are three ways to go: you can use your computer radio to "fool" the servo into thinking its slop is less; you can overhaul the servo mechanics; or you can simply replace the servo entirely.

The first way is the simplest and the cheapest. You can move the pushrod closer to the servo and increase the travel volume to compensate. Most folks use the default travel setting—100 percent—in their radios. However, you can often increase this value quite a bit; some radios permit a throw of 140 percent. If yours does, you can move the pushrod location to 71 percent of where it used to be, jack up the travel to 140 percent and still get the same motion at the control (I got the

Table 1. Ways to reduce slop in servos

Method 1	Move pushrod closer to servo and increase throws more than 100 percent to compensate.	Cheapest, easiest, and quickest. Downside: reduces apparent control speed (servo has to rotate further for same travel).
Method 2	Replace gears or case top.	Somewhat cheaper than replacing the servo entirely (gear sets range from $5 to $40; cases, $5 to $10).
Method 3	Replace servos.	Most expensive but sure to work!

value of 71 percent by dividing 100 by 140). The drawback to this "quick fix" is that the servo arm has to rotate farther to get to where you want it to be. The example above would slow the apparent speed of the servo down by 29 percent. If you can tolerate this reduction, fine; otherwise, try another method.

The second way to reduce slop is to replace the gears or the case top—especially if your servos have a good track record. With ball-bearing outputs, the servo's output gear is unlikely to move much, so the slop probably comes from the gear teeth themselves. Replacing the gears is pretty easy, but unfortunately, I don't have enough space in this column to describe it. (I am working on a feature article on servo repair that will give the full details of how to do this and many other repairs.)

You can usually order replacement gear sets for $6 to $25 and up. Metal gear replacements are particularly expensive, so be sure that the gears are really the problem before you replace them. As a reference, metal-gear servos generally have a bit more slop than plastic-gear servos *when they're new*. Metal-gear servo slop tends to stay the same, while the plastic-gear slop tends to worsen with time.

If your servos don't have ball-bearing outputs, then the slop can come from the top of the case or from gear wear. This is harder to diagnose, but if the hole in the servo case where the output gear comes through is worn, it will produce slop. If the case hole is oversize, your best bet is to replace the case top (with one that has ball bearings, if you can!). EMS* and LDM Industries* sell ball-bearing upgrade kits for some popular servos. If you have Futaba 148 or 3003 servos, you can use a standard-size bearing and the existing case. John Hawkins (parklane@netcom.ca) sells the bearings at http://tor-pw1.netcom.ca/~parklane/index.htm.

The third way to reduce slop is the most expensive: replace the servos! Don't do this unless you have a lot of money to spend, methods 1 and 2 didn't work, or you want faster servos. I recommend that you start by repositioning the pushrod and servo travel, or swap case parts or gears if you can't live with the apparent reduction in servo speed.

SPEEDIER SERVOS

"How can I step up the speed and precision of my model's servos while keeping the size the same? I would like a little more gusto for some of my models' ailerons and elevators."

There are two ways to do this. The first is expensive: replace the servos. Quite often, the servo manufacturer has several servos that use the same case but have different speed or torque values. If you can find a "coreless" servo in the same case, it will usually provide better performance. You may want to refer to the manufacturer's catalog or to an online source such as www.tiac.net/users/verrochi/servoguide.htm. I am also working on a searchable table of all servos (including as many discontinued models as I can find) that will be on my Web page www.flash.net/~dynamic3/ at about the time you receive this magazine.

You can get even more precision from the so-called "digital servos." Both Futaba and JR have recently released servos of this type that have their own microprocessors on board so that they can be made to react faster and with higher torque (among other things). I hope to evaluate some of these servos soon. They have been available in Europe for some time but are not yet common on this side of the Atlantic.

The second way to increase speed and precision paradoxically does nothing to the servos themselves; instead, you replace the battery pack with a 5-cell (6V) pack. This provides higher servo speed and higher torque because the higher voltage allows the servos to consume more power. The downside is that because of the increased current drain, the servos are pushed harder, and this sometimes causes a shorter life. The increased current drain also means that a battery with the same mAh cell capacity will not last as long, so you may need a larger-capacity battery to maintain your current operational time.

Before you change to a 5-cell airborne battery, a few words of caution: check with your radio manufacturer. Some receivers and/or servos will not work properly, although Futaba and JR should be OK because these manufacturers market 5-cell packs in their catalogs. You may also see more servo "jitter"; see the next paragraph for a cure.

One final factor is that as the battery voltage slowly drops, you may notice a slight decrease in servo speed. This makes it a bit more difficult to do precision maneuvers with regularity. For this reason and to reduce servo jitter, several manufacturers offer battery regulators that provide a fixed voltage to the receiver and servos regardless of the battery voltage. These are popular with pattern and aerobatics fliers because they know that the servo will move at a given rate regardless of the state of charge on the battery, so their maneuvers are perfectly consistent. You can get Jaccio or Voltguard battery regulators from several sources, such as Central Hobbies*, Cermark*, Custom Electronics*, Don's Hobbies, Miniature Aircraft*, Radio South* and R/C America*. Custom-made regulators are available direct from Jaccio Products*.

THE LOWDOWN ON 5-CELL, 6V PACKS

The same reader asked, *"What are the ups and downs of 5-cell, 6V packs? How do you charge them? Do you use a voltage regulator? I would like to use 5-cell, 6V packs in a couple of my advanced sport and fun-fly (not competition) planes."*

In this case, I have experience only with Futaba gear, so I encourage readers to write to me if they have experiences with other makes. I use 5-cell packs because I enjoy the increased servo speed and torque. I charge them with either the factory charger or an aftermarket charger. The factory charger seems to work fine, as the red monitor light goes on when I hook up the battery regardless of whether it's a 4- or 5-cell pack. However, I also like to charge my gear when I don't have access to AC power.

For that case, I had good luck with the Sirius Electronics* Charge. The Sirius Charge doesn't seem to care how many cells it's hooked up to! In addition, if you forget to charge your pack overnight, it will usually charge an empty pack within

Table 2. Ways to increase servo speed and resolution

Method 1	Increase battery voltage (5 cells = 6 volts).	This causes higher torque and speed but also higher current drain, meaning less battery life. Also can cause earlier servo failure due to higher "stress" levels. These problems are alleviated with a regulator.
Method 2	Replace servo with coreless or "digital" model.	Most expensive but sure to work!

a couple of hours. It has gotten to the point where I usually just charge on the way to the flying field! (I can get away with this because the batteries are usually not fully discharged, so it takes only 15 to 30 minutes to top 'em off.)

CELL PHONES AND RADIOS

My good friend and flying buddy Mike Stroup dropped me an email regarding an experience he had with his cell phone.

"I was flying my Sukhoi at about 600 feet, and all of the sudden, it got stupid .... It fail-safed and, guess what? At that exact moment, the digital cell phone in my pocket started to ring .... When the plane fail-safed, I held my transmitter straight up in the sky like in the old days [when you experience interference, it's a good idea to hold the transmitter straight up to maximize the signal level going toward the model] *and got it back. One interesting observation was that it would fail-safe shortly after the phone rang, and then control would come back. This would be repeated each time the phone rang. By the way, the plane is OK!*

"I was able to repeat this in the garage. It happened on channel 44; I have not had the chance to try other channels. Maybe this is a well-known situation to avoid and I haven't heard, but if not, perhaps you can issue an advisory [Mike should read my column! This problem was pointed out in the October '99 issue.] *I think there is some interaction between the circuitry in the transmitter and the signal from the phone. At 6 inches between transmitter and phone, I got 100-percent lockup. At 12 inches, lockup was intermittent.*

"This Sukhoi is nicknamed 'Christine' after the Stephen King novel—a real problem child! I think that we should leave cell phones in the car, turned off! *When I fly, I don't want to be interrupted, anyway!"*

So, here's confirmation of the cell-phone problem. From now on, keep your cell phone turned off while you fly; better yet, leave it somewhere far from your transmitter. Now, I wonder whether this applies to pagers as well?

Remember, write to me c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877 USA, or email me at man@airage.com. I get lots of mail, so please be patient!

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.*

by Craig Trachten

HOBBY SHACK SCHOOL BOY

A teacher and playground pal

For aspiring RC flying students who are looking for a capable trainer, or for anyone who wants a schoolyard flyer and some fun at "recess," the Hobby Shack* Schoolboy has just landed on the honor roll.

The plane's components are so compact that I was able to assemble the Schoolboy at the desk in my den. There was little mess, and I enjoyed a change of scenery.

WING ASSEMBLY

Wing assembly consists of joining five pieces using 30-minute epoxy and some masking tape. Remove the overlapping covering on the root rib, leaving approximately 1/16 inch. After marking the center of the dihedral brace, trial-fit the brace into each wing half. An excessively tight fit between the brace and wing will not leave enough room for a good epoxy bond and can create an air pocket that will prevent the brace from sliding

SPECIFICATIONS

Manufacturer: Hobby Shack

Model name: Schoolboy

Model type: 3-channel trainer

Length: 34.5 in.

Wingspan: 50 in.

Wing area: 325 sq. in.

Weight: 2.1 lb.

Wing loading: 15.1 oz./sq. ft.

Engine req'd: .09 to .15

Engine used: AP Hornet .09

Prop: APC 7x4

Muffler: stock

No. of channels req'd: 3

Radio used: Futaba 8UAP with two Futaba S148 servos; FMA Tetra sub-microreceiver, 270mAh battery and one S301 servo (throttle)

Fuel: Morgan's* Omega 15 percent

Street price: $84.99

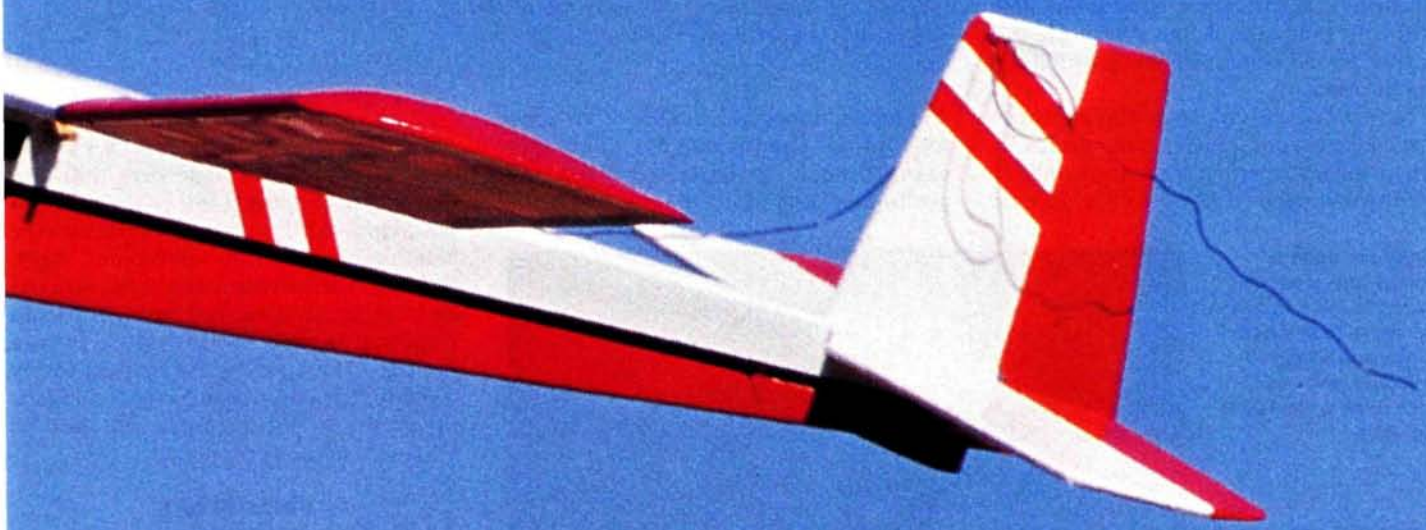
Features: stable polyhedral wing, all-wood construction, polyester covering.

Comments: the Schoolboy is an excellent trainer or back-seat aircraft that can be flown in relatively small spaces.

Hits
- Small-field capabilities.
- High-quality materials.
- Easy construction.

Misses
- Small stock wheels get caught in tall grass.

PHOTOS BY WALTER SIDAS



completely into the wing. Sand any excess wood until the brace fits properly. When I was satisfied with the brace's fit, I epoxied the wing halves together, wiped off the excess adhesive and wrapped the edges of the wing joint with masking tape. Epoxy is like pancake syrup; no matter how careful I am, it still finds a way to get on everything. The tape prevents epoxy from oozing while the joint cures. After peeling away the tape, I removed the covering where wing doublers are affixed and glued the doublers into place. I used Pacer's* CA Gel instead of the recommended 5-minute epoxy here; I do this wherever parts aren't subjected to excessive stress.

EMPENNAGE

Start by removing the elevator from the horizontal stabilizer. Place the horizontal stabilizer perpendicular to the fuselage and parallel to the wing. If necessary, sand the mounting plate to establish a square mount. Score a line on each side of the stab bottom where it meets the fuselage, and peel the covering away from this inner marked area. Apply 30-minute epoxy to the exposed stab area and reinstall the stabilizer as previously positioned.

Install the vertical fin using the same technique as you did with the stab. I run a piece of masking tape from one side of the horizontal stabilizer over the top of the fin to the opposite side of the stab, checking the alignment before the epoxy sets.

Measure, mark and install the control horns as instructed.

SUBASSEMBLIES

The CA hinges are already in place but aren't glued. With the surfaces in place, bend the control 45 degrees and apply thin CA to each hinge. This is where Bob Smith's* no. 322 fine-tip applicators come in handy to achieve pinpoint glue accuracy. Bend the surface 45 degrees in the opposite direction and repeat.

Cut the nose-wheel pushrod guide to 6 inches long, and insert it through the lower left hole in the fuselage bulkhead. With the Z-bend facing the front of the aircraft, slide the wire into the shroud and attach the steering arm as instructed. The wheels are held to the landing gear with wheel collars.

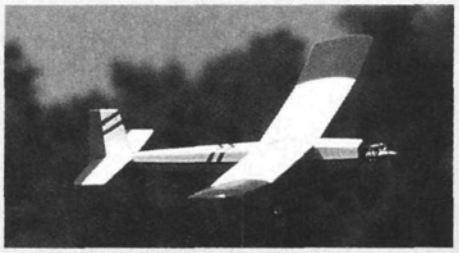
Four 3x16mm machine screws hold the engine mount to the firewall with blind nuts. I place a piece of masking tape on the top of each rail before I mark my engine-mounting holes. It is easier to see a pencil mark on a piece of tape than on the dark mount. Check the alignment and drill your holes, but before you secure the engine, install and attach the pushrod for the throttle.

Screw the servos into the factory-installed plywood rails and be certain to orient the servo output arms as pictured. I used two Futaba* S148 servos for elevator and rudder duties and an FMA* S301 servo for throttle. The instructions thoroughly explain making and installing the pushrods; it isn't difficult.

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

Because the Schoolboy has such small wheels, you must fly it from short grass or hard runways to take off properly. The simplest solution is to use bigger tires or to simply hand-launch the model. The AP Hornet .09 engine pulls the Schoolboy well and easily gets the model airborne. The model's light wing loading enables it to fly and land at a walking pace while its wide-track tricycle landing gear offers excellent ground handling.



• HIGH-SPEED PERFORMANCE

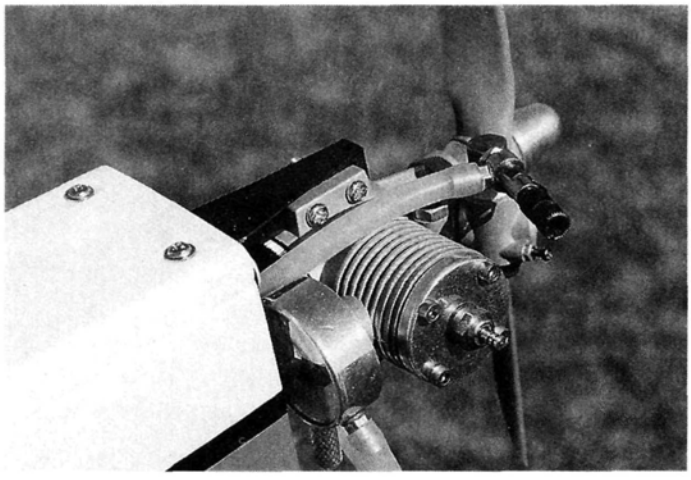
At full throttle, the plane tracks well without ballooning and shows no indication of flutter. The aerodynamic drag of the comparatively large wing versus the .09 power prevents the plane from achieving ballistic speed, but it obviously wasn't meant for such performances.

• LOW-SPEED PERFORMANCE

The model's low-speed performance during takeoff is very impressive. Even trying to make the airplane misbehave required genuine effort. I forced the nose up steeply, reduced power and just waited. The plane stopped in the air at the same angle of attack as it began the climb, pirouetted over on its right wing and resumed flying in about 8 feet.

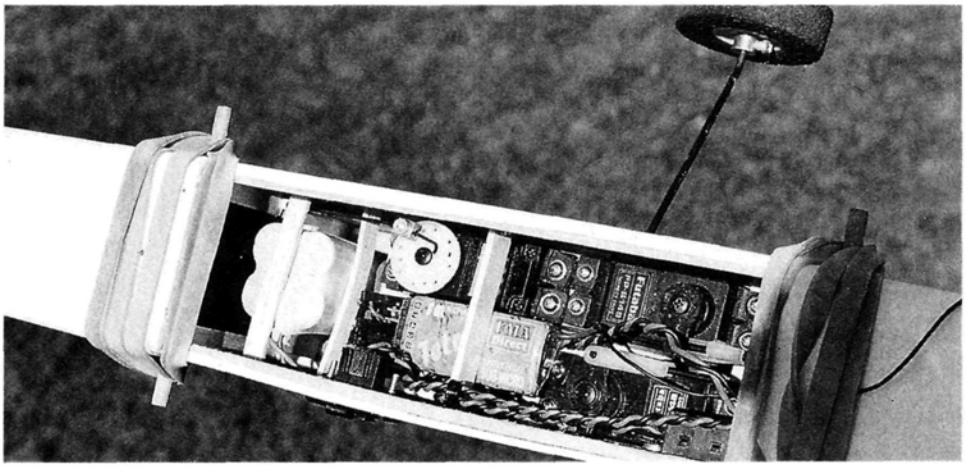
• AEROBATICS

With increased control throws, the Schoolboy is quite agile. Its polyhedral wing and lack of ailerons prevent it from doing tight axial rolls; however, it will snap, barrel-roll and loop with ease. To avoid overstressing the wing, however, I recommend avoiding high-G maneuvers.



Right: the quiet AP Hornet .09—a perfect match to the airframe—has more than ample power and a host of welcome features such as a vertical needle valve.

Below: the area beneath the wing is a little tight, but the Schoolboy will accommodate standard-size radio gear.



FUEL TANK

You will have to build the fuel tank before you can install it. Make sure that any flashing on the inside rim of the tank has been removed and no burrs remain on the aluminum tubes. This will ensure a tight, leak-free seal between the tank, stopper and tubing. Insulate the tank with foam padding before mounting it in the fuselage. The tank should be held firmly in place, but don't overstuff the compartment; if you do, the foam will lose its vibration-damping properties.

FINAL STEPS

To finish up the Schoolboy, install the receiver and battery as pictured in the instructions. I chose a 270mAh receiver pack and FMA's Tetra sub-microreceiver. Check the center of gravity and adjust the placement to achieve the proper location (2⅛ inches back from the wing's leading edge). Set the control throws as outlined, fuel up and go fly!

MAKING THE GRADE

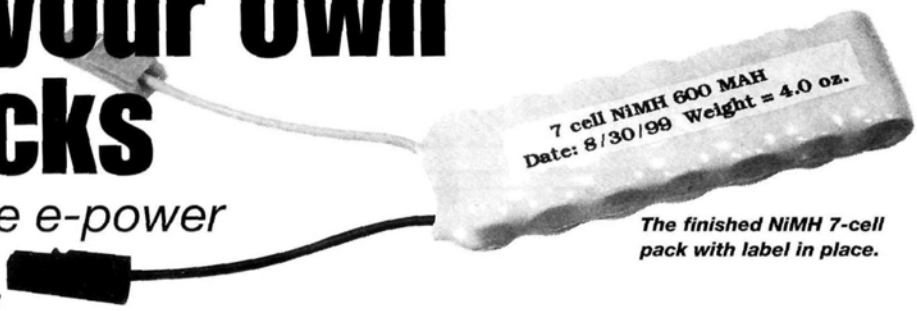
When combined with the AP Hornet .09, Hobby Shack's Schoolboy is quiet and well-mannered. When I fill out its report card, I'll check the boxes marked "cooperative," "follows instructions" and "plays well with others." If you're looking for a hatchback-size, forgiving but fun model, the Schoolboy can't be outclassed!

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.*

Assemble your own battery packs

Low-cost, custom-made e-power

by Bob Aberle



The finished NiMH 7-cell pack with label in place.

Assembling your own battery packs allows you to design configurations that will fit exactly into the space available in your electric-powered models. In some cases, you can obtain good deals on surplus cells; other times, new cells are simply obtained individually at excellent prices. Some sources of battery cells are SR Batteries*, B&T R/C Products*, E.H. Yost & Co.* and TNR Technical*, to name a few.

THE TOOLS

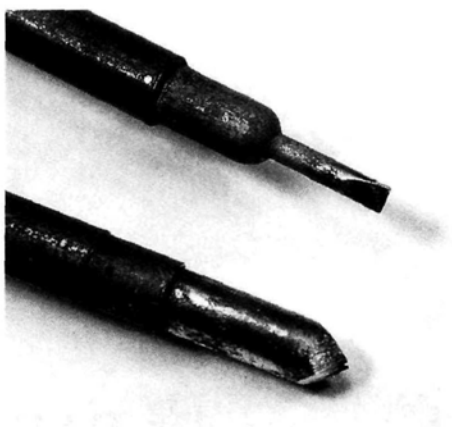
Let me dwell for a moment on the various tools and materials you will use. The soldering iron is most critical, since applying too little or too much heat can ruin the job and the cells. For the last 10 years, I have used a pair of Ungar* soldering irons that have handles, separate heating elements and replaceable tips. The heating elements last a long time, and the tips that wear out regularly can easily be replaced. I have also used a RadioShack handle (part no. 64-2110) along with a 45-watt heating element (RSU 11461639, which must be specially ordered), a lighter-duty 35-watt heating element (64-2112) and copper tips (three to a package; light, medium and heavy-duty—64-2084). Use the heavy-duty tip with the 45-watt element and the medium tip with the 35-watt element. My rule of thumb is that battery packs with cells of up to about 600mAh capacity can be soldered with a 33-watt heating element and a small chisel tip. For roughly 800mAh cells on up, you will need a 45-watt heating element and a large (at least ¼-inch-diameter) chisel tip.

The next important item is the solder itself. This must always be of the rosin-core variety with a tin/lead ratio of 60:40 and made expressly for electrical wiring. I like to use very thin-gauge solder because it melts more easily. A good solder is RadioShack no. 64-005 that has a 0.032-inch diameter. Although the solder contains rosin flux, I prefer to add some liquid rosin flux. My favorite is Sears Craftsman Liquid Rosin Soldering Flux (980063). I use a small artist's brush to apply this.

ASSEMBLING A PACK

Now we get to the actual battery-pack assembly. I make holding fixtures that help keep the individual cells in place out of scrap balsa. Hobby Lobby Intl.* offers ready-made holding fixtures for certain (but not all) pack configurations.

The first step is to arrange the battery cells with the proper polarity. Because the cells are always connected in series, it is strictly a process of connecting positive to negative terminals all the way through the pack with a final positive and negative cable wire coming off each end of the pack, terminating in the more usual Sermos R/C Snap



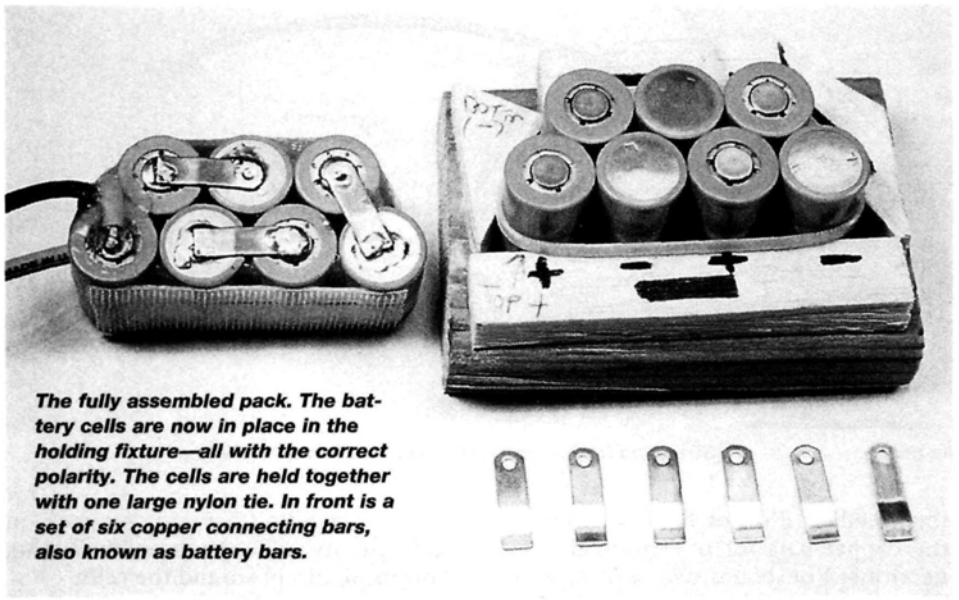
The smaller chisel tip is used on a 33-watt soldering-iron heating element on battery packs of 600mAh and smaller capacity. The larger tip is on a 45-watt heating element and is used for packs of 800mAH and larger.

YOU'LL NEED

- A soldering iron
- A holder for the soldering iron
- Solder
- Solder flux
- Emery paper (fine)
- Wire
- Copper braid
- Copper battery bars
- Heat-shrink tubing
- Wire cutters
- A battery-holding fixture
- Battery connectors
- The battery cells

The tools and items necessary to assembly battery packs: a soldering-iron holder, two soldering irons, liquid flux, solder, heat-shrink tubing, wire, battery cells and a homemade holding fixture.

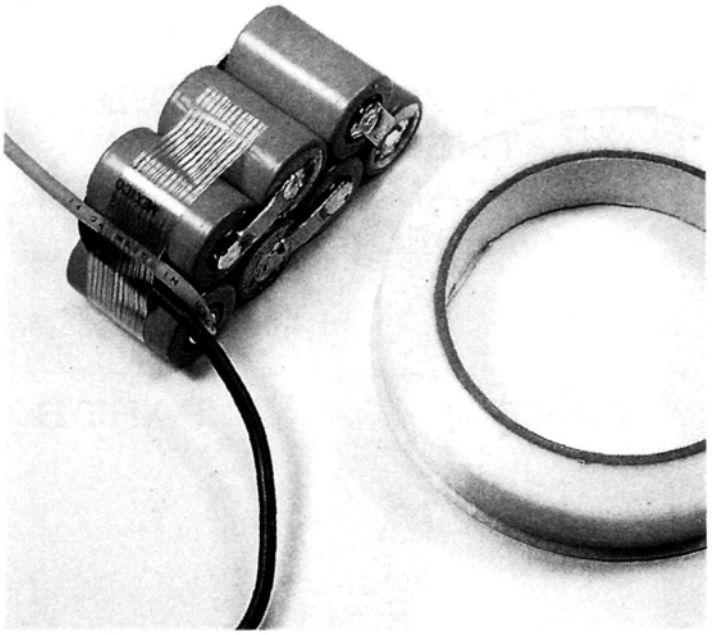
PHOTOS BY BOB ABERLE



The fully assembled pack. The battery cells are now in place in the holding fixture—all with the correct polarity. The cells are held together with one large nylon tie. In front is a set of six copper connecting bars, also known as battery bars.

Connector*. For this article, I first assembled a pack of seven Sanyo red jacket 1250mAh cells in the popular 3-over 4-cell arrangement that allows me to easily wrap one nylon tie around all the cells to hold them in place during assembly. When you assemble in-line or flat packs, it is helpful to tack each cell to the next with a little thick CA, using accelerator sparingly.

On 800mAh and larger packs, I always make my inter-cell connections with copper bars, also known as battery bars. You can buy these from B&T R/C Products. Each bar must be carefully soldered in place on the battery terminals. The number of bars required is always one less than the number of cells. You can buy cells that have a solder terminal already spot-welded in place, but on some of my limited-motor-run (LMR) packs, from which I draw on the order of 50 to 60 amps for short duration, I prefer the heavier copper connecting bars.



The two exiting wires are crisscrossed on one end of the pack and then held in place with wrapping tape (a very strong tape!).

SOLDERING TECHNIQUES

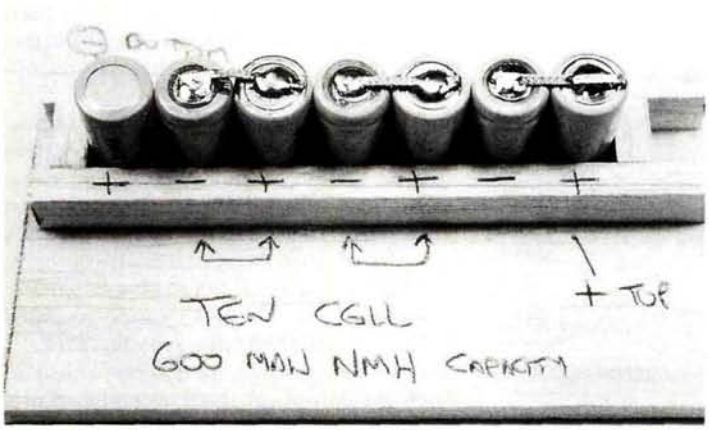
Let's proceed with soldering. First, lightly sand the battery cell ends with some fine emery paper to clean the metal. Now place a few drops of the liquid flux on the ends of the battery cells. Next, pre-tin or pre-solder the cell ends. First touch the cell end with the hot iron and let the heat build up for a few seconds. Then quickly introduce the solder and let it melt until you see a shiny flow of solder on top of the battery cell. Repeat this with the adjacent cell that will receive the other end of the copper bar. Now, place the copper bar across the two battery cells that you have just pre-soldered. Touch the iron to the top of the copper bar and hold for a few seconds while you introduce a little more solder from the top. Let this continue to heat until the solder flows freely between the copper bar and the cell end. Remove the iron and let it cool for about 10 seconds. Repeat at the other end of this same copper bar. Add two more copper bars, then remove the pack from the holding fixture, flip it over, and add three more copper bars, for a total of six.

This should leave the pack with a positive terminal on one end and a negative one on the other end. Attach your cable wires to these terminals. Pre-tin both cell ends and prepare red and black lengths of wire to attach to these cells. On battery packs of 800mAh and greater capacity, I use 12- or 13-gauge stranded wire; for 600mAh and smaller packs, I use 16-gauge wire. Just strip about ¼ inch insulation off the wire end and pre-tin the exposed wire. Apply the iron to the pre-tinned cell end, let the solder melt, and then hold the tinned end of the wire over this flowing solder. Hold the heat for a second and then remove the iron. Be careful not to melt the wire insulation. Use red wire for positive polarity and black for negative.

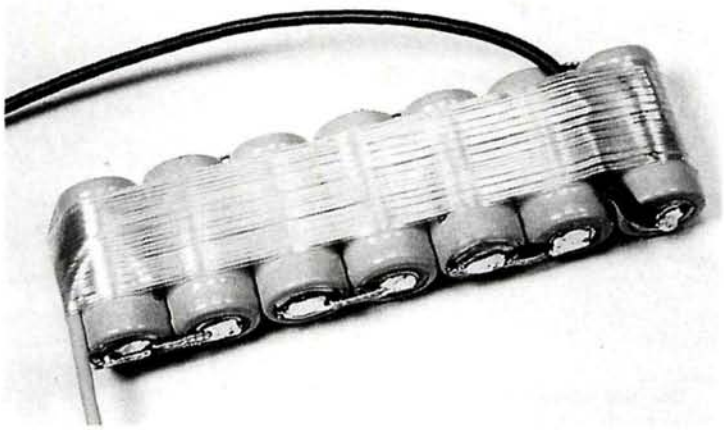
Remove the nylon tie, if one was used. Try to arrange the exiting wires so that a piece of wrapping tape can relieve some of the strain placed on the cable. I crisscross the wires on one end and then wrap the tape all the way around the pack. You could finish off this assembled pack with large-diameter heat-shrink tubing. In this example, and with the use of copper bars, I simply held everything together with wrapping tape.

The last item is to attach connectors to the wire ends. I favor the Sermos R/C snap connectors. Be sure to use a red connector on the red wire for positive and a black connector on the negative wire. Because I am so committed to e-powered flight, I bought a special mechanical crimping tool from Sermos that perfectly connects the wire to the silver-plated pin. These crimping tools are expensive at around $150 but well worth it in the long haul.

A Sermos mechanical crimping tool makes every wire-to-pin connection a perfect job in seconds. At $150, it is expensive, but it's a must-have for the dedicated e-power modeler!



All the copper braids are in place on one side of the pack.



Strapping tape is used for strain-relief on both wires.

After the pack has been completely assembled, charge it overnight for the first time at the C/10 rate. In this case, the cells have a 1250mAh rating, which is the same as 1.25 amp/hour. Divide the capacity of 1,250 by 10, and you have 125mA (milliamperes). That's the slow charge rate you should use for the first 24-hour period.

I also assembled a straight-line pack using smaller 600mAh NiMH cells. I placed a small amount of thick CA between each cell to keep them in place while I soldered them. Because these are small cells, I did not have to resort to the copper bars for the inter-cell connections. You could use regular wire, but my choice on small packs is ⅛-inch-wide copper braid, also known as solder wick or desoldering braid. The rest of the assembly steps are the same. Don't forget to lightly clean the battery terminal ends with fine emery paper. On this pack, I used the wrapping tape once again to relieve the strain on the wires, but I used heat-shrink tubing as the outer cover. You can do this by inserting the pack inside the tubing with about ¼ inch extending beyond the pack on each end. As you apply heat, the tubing will shrink nicely around the cells.

You now have a completed battery pack. I keep track of all my batteries; each is labeled with the assembly date, number of cells and capacity. If I make two packs at the same time, I number them 1, 2, etc. Give it a try!

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.* ✦

PRODUCT WATCH

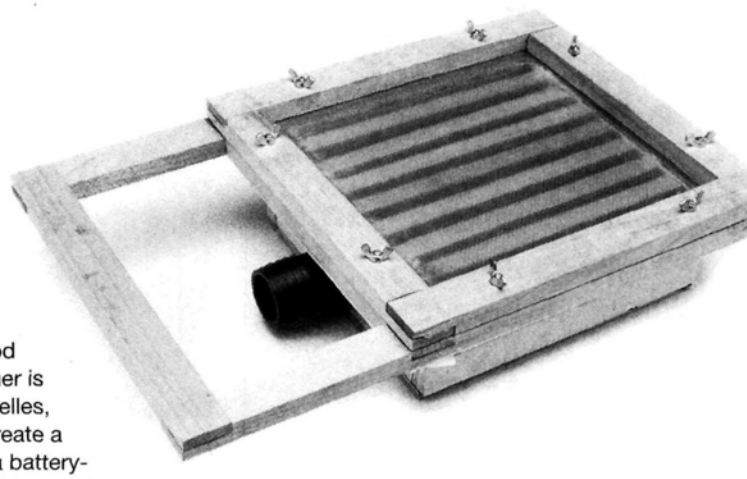
Editors' picks of the month

AT MODEL AIRPLANE NEWS, we not only tell you what's new, but we try it out first to bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."

CROSS HOBBY TOOLS

Vac-Former

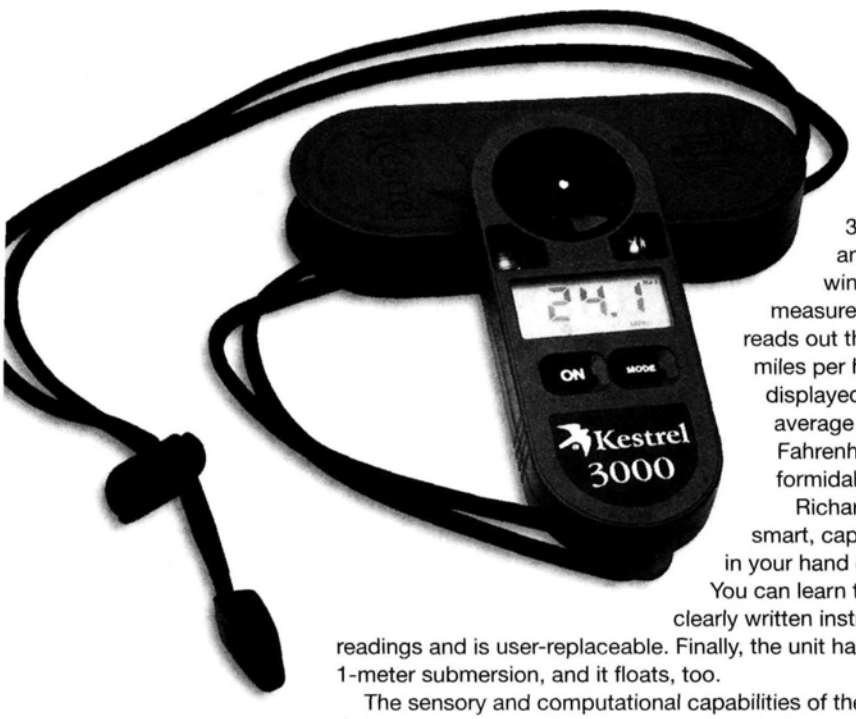
Workshop wonder



Al Cross of Kanata, Ontario, Canada, decided that what the modeling world needed was a good, inexpensive vacuum-former. Through his company, Cross Hobby Tools, he has taken a two-pronged approach to achieving that with the Vac-Former. Cross Hobby Tools offers an illustrated 27-page guide on how to scratch-build a vacuum-former from hardwood. I opted for the easy way: I made one from their precut kit. The kit contains top-quality milled hardwood and hardware and can be made in very little time. The Vac-Former is an invaluable tool when you make custom canopies, cowls, nacelles, fairings, louvers and more. My first attempt at molding was to create a new battery holder/cockpit for a small electric Bleriot. I crafted a battery-pack-size mold from self-hardening clay. After the clay had set, I inserted a Lexan sheet into the Vac-Former's frame, tightened the clamping wing nuts and warmed the sheet with a heat gun. I switched on the shop vacuum and attached the hose to the Vac-Former. Only slight pressure is necessary to draw the lid down over the plug; the vacuum handles the rest. Hey, this borders on being fun! In only a few short weeks, I've created wingtip strobe "blisters," a slick set of cooling ducts for a glider and a custom canopy for my once-bare shoulder-wing plane. Next are some dummy engine cylinders for a scale project that's in the works. Uncover new modeling possibilities with the Vac-Former. Pick up the scratch-building instructions for $10, or begin the adventure sooner by picking up the kit for $49.95.

—Bob Hastings

Cross Hobby Tools, 1 Sandwell Crescent, Sandwell, Ontario, Canada K2K 1V2; (877) 599-6555 (orders); (613) 599-6555; fax (613) 599-3314; info@crosshobbytools.com; www.crosshobbytools.com.



KESTREL

Kestrel 3000 Pocket Weather Meter

Wind beneath my wings

Here is an amazing instrument for weather watchers. The new Kestrel 3000 Pocket Weather Meter packs a remarkable amount of sensory instrumentation and calculating power into a slim, light, waterproof, pocket-size case. The Kestrel 3000 hand-held instrument measures wind speed, air temperature and humidity. From these concurrent measurements, it calculates wind-chill factor, heat index and dew-point temperature. The Kestrel measures wind speeds from 0.7mph to 89mph to 3-percent accuracy and reads out these values in knots, meters per second, kilometers per hour, miles per hour, feet per minute or Beaufort force. Wind speed can be displayed in moving 3-second average, maximum 3-second gust, or average speed. It shows air-temperature readings in Centigrade or Fahrenheit and displays relative-humidity percentage as well. This is a formidable amount of calculating power in a small, convenient package.

Richard Kellerman and Paul Nielsen have really figured out how to make smart, capable and tough portable measuring devices. The case fits easily in your hand or pocket, and the two button controls are brilliantly designed. You can learn to use all of the device's features by spending 10 minutes with the clearly written instruction sheet. The battery is good for an estimated 300 hours of readings and is user-replaceable. Finally, the unit has a slip-on hard case and a lanyard. The meter is waterproof to 1-meter submersion, and it floats, too.

The sensory and computational capabilities of the Kestrel 3000 meter are stunning, and it will be useful in a large variety of outdoor endeavors, including RC slope soaring, thermal duration flying and management of any RC flying contests and events. Price—$159.

—Dave Garwood

Nielsen-Kellerman, 104 West 15th St., Chester, PA 19013; (610) 447-1555; fax (610) 447-1557; kestrel@nkelectronics.com; www.kestrel-instruments.com.

HOBBY CLUB USA

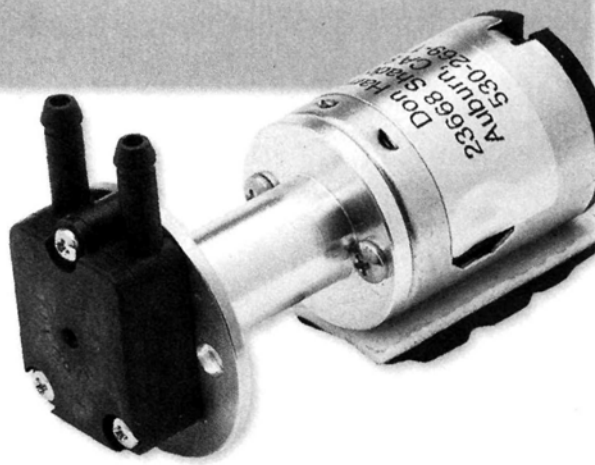
Spray Mate

Let us spray

Do you remember the days when you set down your roll of paper towels and then had to chase it down the runway? Thanks to the Spray Mate, those days are over. This innovative new product is a roll of paper towels and a bottle of spray cleaner in one! You'll no longer wish that you had three hands when you clean your prized airplane. Simply spritz your model with your favorite liquid cleaner, then rip a paper towel off the side of the bottle and wipe the dirt and oil away without setting anything down. It's as easy as that! The Spray Mate holds up to 18 ounces of fluid and has a dip tube long enough to get every last drop of cleaner out of the bottle. This creation will work with any brand of paper towels, and the plastic rod on the side prevents the roll from unspooling, too. The Spray Mate will surely become one of the most-loved additions to your flight box since the electric fuel pump!

—Geoff Cozine

Hobby Club USA, 10771 Monte Vista, Ontario, CA 91762; (909) 628-4300.



DON HARRIS

Module Smoke Pump

Where there's smoke, there's flier

When you start flying giant-scale aerobatic airplanes such as CAP 232s, Staudachers, Giles and the like, you soon start to think about smoke—not the cigar variety, but the white, long-lasting skywriter's smoke that comes out of your exhaust system. After watching a friend's model spew out the thickest smoke trail I had ever seen, I asked him what his setup was. He answered with two words: Don Harris.

Don's module smoke pump is just one part of the smoke system that he sells, but because I already had a smoke muffler for my 3W 60-powered model, Don supplied me with the motor, pump and plumbing to finish the job.

The pump is not run-of-the-mill! To keep radio interference to an absolute minimum, i.e., nonexistent, Don winds the armatures himself and then solders three, 750-ohm resistors directly to the commutator. The motor is then grounded to the case, and Don adds a 0.1-microfarad capacitor across the brushes. Two circuit filters and a diode are also added to the control module to trap any remaining electronic "noise."

The motor is attached to the pump with an aluminum adapter, and the control module is plugged directly into an auxiliary channel in your receiver. Use a 1400mAh or larger battery pack to power your radio system. For an additional charge, Don also offers a pump motor wired for an auxiliary battery. The pump weighs only 3 ounces and comes with a filter and a check valve. The filter goes between the smoke fluid tank and the pump, while the check valve goes between the pump and the muffler.

The system requires a three-line smoke-fluid tank setup with a separate vent and fill line. The pump does not pressurize the tank; it draws the fluid out—and boy, does it ever draw! The pump will dry-prime itself in no time and is capable of drawing smoke fluid through several (6 to 8) feet of tubing with ease.

The motor/pump unit must be wrapped with foam just as you would a receiver pack, and it should be secured inside the fuselage with additional foam. I hooked the smoke system up to the retract switch on my transmitter and then used the endpoint adjustments to dial in the on and off positions of the switch. After approximately six flights, the motor used only 200mAh—almost nothing.

Don recommends B&B Specialties smoke fluid, and he is very proud of the fact that at the last Tournament of Champions in Las Vegas, NV, 10 of his systems were used by the pilots. I think that's as good a recommendation as you can ask for. Prices—$85 (module pump); $90 (pump wired for auxiliary battery).

—Gerry Yarrish

Don Harris, 23668 Shadow Dr., Auburn, CA 95602; (530) 269-1164.

Manufacturers! To have your products featured here, send them to **Model Airplane News**, attention: Product Watch, Air Age Inc., 100 East Ridge, Ridgefield, CT 06877-4606 USA.

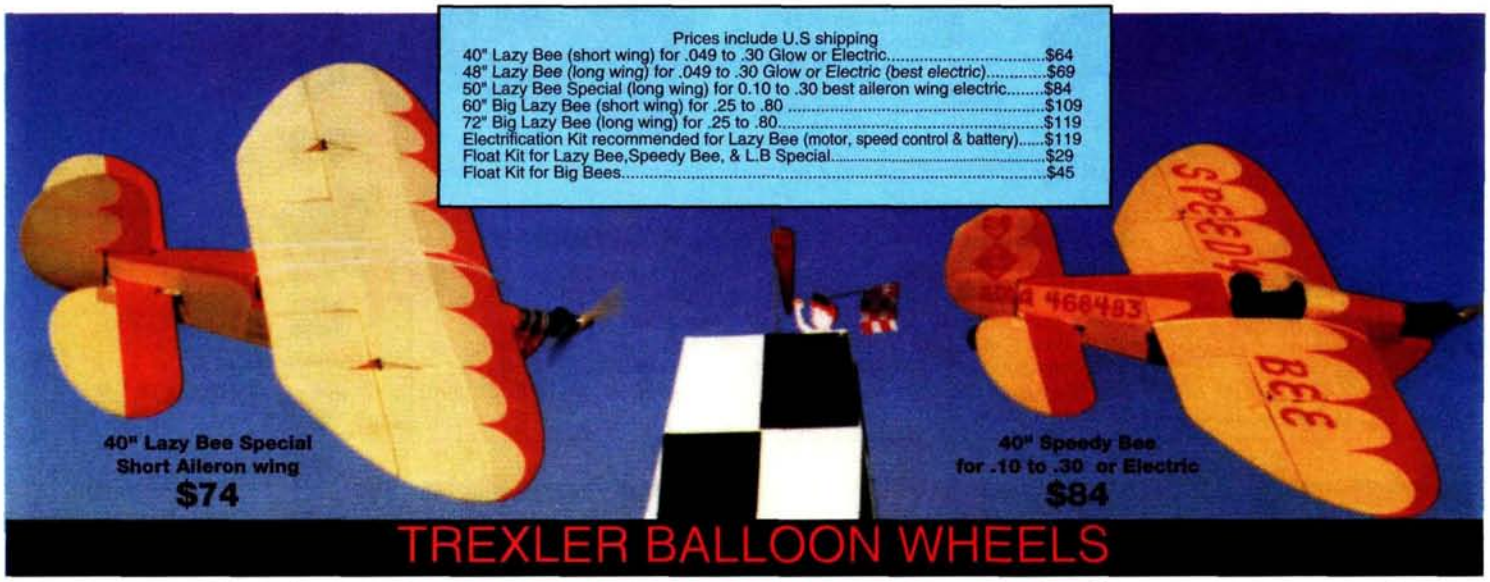
Please don't let the zany hot-doggin' you have seen our Bees performing fool you into thinking that it's just a hot rod. Most guys simply can't resist flying them that way because the Bee lets them get away with things no other plane would survive. So please forgive them if they fly a little too low, or too close, or show off a little. The excitement of flying a Bee brings out the Walter Mitty in every pilot.

Beginners build confidence by flying a Bee because it survives the many hard landings and mistakes that a novice flyer makes. The novice can get lots more flight time because he's still got a plane! Unlike a trainer, a Bee never becomes boring. You can transform a Bee from mild to wild simply by changing the throw of its oversized control surfaces. Bees hold the interest and attention of pilots of any skilll.

Long wing Bee's are docile and glider-like. They are the most popul for Electric. Short wing Bee's are for aerobatics and windy weather. Th Speedy Bee and Lazy Bee Specials have ailerons. Lazy Bees, Big Bee and Speedy Bees can be converted from land to water and snow flyir with float kits. The Yard Bee is very quick to build, and includes har ware and iron-on covering. It flies on glow power from .010 to .10. It light enough for indoor electric power and stong enough for Spee 400s. It's probably the lightest plane that can fly with a Speed 400.

Prices include U.S shipping

40" Lazy Bee (short wing) for .049 to .30 Glow or Electric	$64
48" Lazy Bee (long wing) for .049 to .30 Glow or Electric (best electric)	$69
50" Lazy Bee Special (long wing) for 0.10 to .30 best aileron wing electric	$84
60" Big Lazy Bee (short wing) for .25 to .80	$109
72" Big Lazy Bee (long wing) for .25 to .80	$119
Electrification Kit recommended for Lazy Bee (motor, speed control & battery)	$119
Float Kit for Lazy Bee,Speedy Bee, & L.B Special	$29
Float Kit for Big Bees	$45



TREXLER BALLOON WHEELS

Trexler Balloon Wheels have been in continuous production since 1936. In those days we had no radios to guide our planes for a good landing. So we needed all the help we could get to get our planes down without damage. The inflatable Trexler Balloon Wheels provide plenty of shock absorption for smooth landings. Today we have radios to guide our planes, but we still need all the help we can get to land without damaging our planes and/or our pride.

Trexler's inflatable balloon wheels are the softest, and most energy-absorbing wheels in the model airplane industry. They make landings that would normally tear off the landing gear into a harmless bounce. These wheels are extremely light for their size, too.

Clancy Aviation distributes all sizes of these wheels, and we also include special plugs for the inflation stems that our competitors don have. We also carry special heavy duty versions of some of the smalle wheel sizes. The smaller sizes are usually only suitable for very light rub ber-powered planes, but the heavy duty versions will work with today' small R/C planes. If you order sizes 1 thru 6 for small R/C planes, ask fc the heavy duty version.

Trexler Hand Pump - $8.00 This is a bulb pump with a valve that inflate the wheels as you squeeze the bulb. Recommended for sizes 10G an up, but it works well for all of the wheels and is easy to operate.

Pneumatic Pump - $4.00 This is a simple pump (no valve) made from 2 oz. syringe, but it works very well for inflating the smaller Trexle wheels. It is good for the wheels up to size 9G.

Wheel size	Dia.	Weight	Cost per pr
#1	1 1/4" - 1 3/8"	.15 oz.	$6
#2	1 1/2" - 1 5/8"	.15 oz.	$6
#3	1 3/4" -1 7?8"	.30 oz.	$6
#4	2" - 2 1/48"	.35 oz.	$6
#5	2 1/4" - 2 5/8"	.35 oz.	$7
#6	2 1/2" - 2 5/8"	.35 oz.	$7
#8G	2 3/4"	1.0 oz.	$10
#9G	3"	1.5 oz.	$12
#10G	3 1/2"	2.0 oz.	$14
#11G	4 1/2"	3.0 oz.	$16
#12G	6"	6.0 oz.	$30

For additional information, please contact

Clancy Aviation

Telephone: 480-649-1534
Fax: 480-649-9040
Hours: Mon.-Fri. 10 am - 4 pm (MST)

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Scale building techniques from a master

Detail the Balsa USA 1/3-scale Super Cub

by Charlie Viosca

I ORIGINALLY REVIEWED the Balsa USA* 1/3-scale Super Cub in the June '98 issue of *Model Airplane News*. While this is a great plane, detailing the Super Cub will add much more to this miniature aircraft. It will take a lot of time and patience, but the result will make it all worthwhile. In this article, I discuss the installation of working cockpit controls, as well as a realistic instrument panel and side panels for the Super Cub; you could easily use these ideas on any large-scale cabin plane.

It's important to think ahead. For instance, when you build the fuselage, you should install the working cockpit throttles before you join the left and right sides. To do that, you have to install the servo mount and cut a groove through the left side for the throttle pushrod (see Figure 1). Remember, the cockpit controls do not have any control over flight. The controls—powered by Futaba* S-3103 micro miniservos—merely mimic the action of the flight controls.

SIDE PANELS

Make the side panels out of thin, 0.011-inch aluminum sheet, from print shops or good hardware stores, sold as chimney flashing. Bend the top throttle cover as shown in Figure 1. The lower panel has holes for the fuel, magneto and trim panels as shown in Figure 4. Fasten the panels to the model with no. 2 button-head socket screws. The right side panel contains the door cutout. All of the aluminum panels should be black; the square magneto switch block and fuel selector valve, red; all lettering, white; the trim crank, silver; the magneto switch guards, black. The throttle balls should be 3/8 inch in diameter and painted black. Drill and tap them for 2-56 bolts. Be sure that the throttles have a clearance of 1/16 inch above the side panel when advanced and retarded.

FLIGHT CONTROLS

For the flight controls, refer to Figures 2 and 3. Cut an 1/8-inch-thick, 14x8-inch-ply floor and install it, starting at former F2. The front floor is 6 inches long and 8 inches wide at former F2 to 6 inches wide at the front. It should be painted black. Glue 1/4x1/2-inch spruce crosspieces at the bottom of both sides of F2. Glue another crosspiece 8 inches back. The floor can be screwed to these pieces.

The flight controls are made of 1/4-inch brass tube. The control sticks are 5 inches tall and are bent slightly rearward at a point 2 inches down from the top. I used ball bearings on the aileron tube, but 1/4-inch-i.d. tube is an acceptable substitute. Install the bearings before you solder the stick mounts to the aileron tube. A 1/4-inch brass strap holds the bearings to the pillow block. Mount the aileron servo on the floor just to the left of the tube so the front seat hides it.

For the elevator control, pass a 1/16-inch solid rod through the aileron tube and attach it to the front stick with a clevis. Solder a 1/16-inch pin to the rod to connect the rear stick; there isn't enough room for a clevis. Attach the other end of the elevator rod to the elevator servo. Mount the control sticks to the floor.

Fuel and trim panels are shown on Figure 4. Make a fuel knob by hollowing out a piece of Styrofoam roughly in the shape of the knob; then pack in some JB Weld*. When it's hard, cut away the foam and shape the knob with a motor tool. Drill and tap a hole through the knob for a 2-56 screw. When you mount the fuel panel, place a fiber washer between the panel and the knob, and put a fiber lock-

nut behind the panel.

Make the trim panel so that it moves the indicator as shown in Figure 4. Use a small, 0.013-inch pull/pull cable and wind it so that the cable comes off the shaft at the bottom. Start by inserting the cable through the two small holes in the shaft, first winding the cable closest to the panel. Make three winds, then move to the pulley. Wind the other cable in the same fashion. Now you will probably need a helper. Take one cable and make a swage on it, then pass it through the small hole in the indicator. Now take the other cable, put a swage on it as well, and pass it through the first swage. With the indicator centered and the cables on the pulleys, pull the cables tight and hold them while a helper mashes the swages. Now you should be able to turn the knob, and the indicator will show the trim position.

The ones on the bottom row are oil pressure, temperature, rpm, and turn and bank gauges, remote indicating compass, V.O.R./I.L.S. indicator and suction gauge. Balsa USA includes the glass instrument covers with instructions to paint the inside of the bezels black, but I recommend that you glue O-rings into the bezels.

Cut the panel out of the aluminum sheet in the kit, and make sure to use a sheet of 1/16-inch ply on either side to keep the aluminum from balling up, as recommended in the manual. Paint the panel black. You can obtain beautifully colored instrument sheets from JP Products*. Using your panel as a guide, draw the gauge circles on a piece of cardboard and glue your instruments in place. Then, glue the glass instrument covers onto the gauges using Microscale* Kristal Klear adhesive. When the adhesive is dry, glue the aluminum instrument panel to the cardboard; you are ready to install it in the model.

I added a RadioShack sub-mini-switch to shut off the cockpit servos when not in use. To do this, remove all the negative wires from the four cockpit servo plugs and cut the metal plugs off three of them. Cut the fourth about 2 inches away from the plug and solder to it a wire that will lead to your switch (on the instrument panel) then back to the four servo wires, which you solder together. Put the remaining plug back into one of the servo plugs.

SEATS

I made the front seat out of 1/4-inch brass tube. The seat-bottom frame is a 4 1/2-inch square of brass tube. Make the seat back 9 inches tall and 4 1/2 inches wide. Solder the seat bottom to the seat back 3 inches up from the bottom and solder two, 3-inch

The full-size Cub's instrument panel.

The panels of the left side of the full-size Cub's cockpit.

Make the trim arm by flattening a piece of 1/8-inch brass tube, which will leave the ridge lines that you want. Solder this flattened tube to a 1/4-inch wheel collar. Bend it slightly toward the panel and solder a smaller collar to the other end. Use epoxy to fill the holes and also to give the large collar a tapered shape from the base to the top. Drill the large wheel collar and tap it for a small setscrew. Use the setscrew to attach the arm to the shaft.

INSTRUMENT PANEL

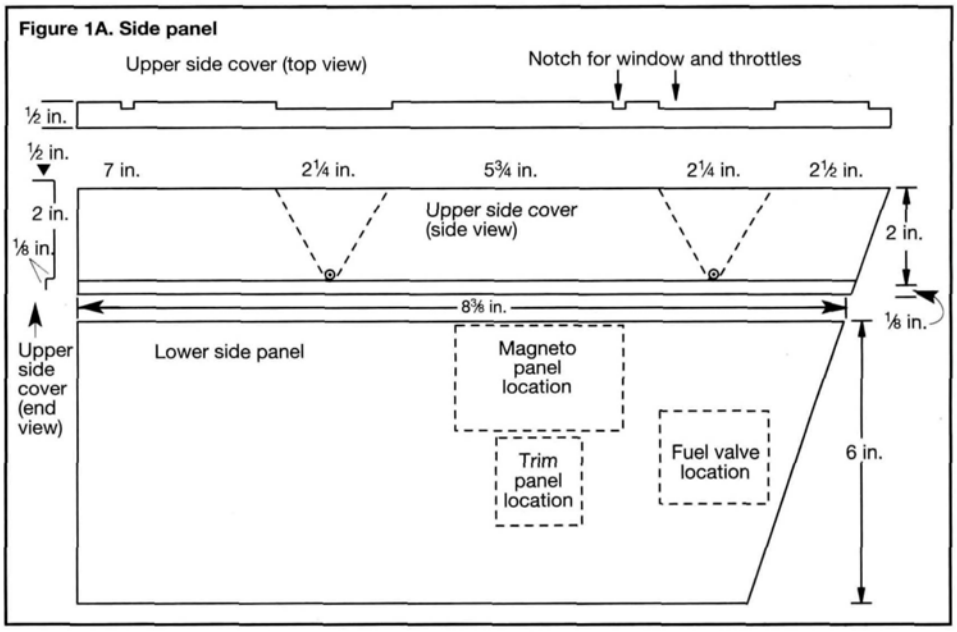
Cut the instrument panel as shown in Figure 5. From left, the instruments on the top row are compass, artificial horizon, altimeter and clock.

The 1/3-scale Cub's cockpit with seat removed, close to the real thing.

front legs into place. Cover the seat bottom frame with black vinyl, glued with CA. Sew a vinyl cover for the seat back and slip it over. Make seat cushions by sewing black vinyl around squares of 1/2-inch foam. Cut a 3-inch-square, black vinyl pocket, and sew a clear plastic holder 2 1/4 inches wide and 1 1/2 inches tall to the pocket, leaving an opening on the right side. Now, sew this pocket to the rear of the seat cover. Reduce an airworthiness certificate to 1/3 scale and slide it into the clear holder along with a scale color WAC chart that goes into the pocket.

Make the rear seat from three 1/4-inch dowels cut to 8 1/4 inches. The first dowel

The 1/3-scale front seat pocket, complete with airworthiness certificate and WAC chart.



will be the top rear of the seat and will go across from side to side 2⅜ inches forward of F3. The next dowel goes below the top dowel, ½ inch below the lower door line. The third goes ½ inch forward of the lower door line, ½ inch below. On the left side of the model, drill a ¼-inch-diameter hole ¼ inch deep to accept each dowel. On the right side, drill holes 5/16 inch in diameter, ¼ inch deep. Make three ⅝-inch-long fittings out of ¼-inch-i.d. brass tube, and cut them halfway down ¼ inch from one end. From the end, cut back to the first cut and remove this piece. Smooth the edges and epoxy them into the holes in the right side.

Drill a no. 50 hole in one end of each dowel; install dowels for the seat. Through the holes already in the dowels, drill a no. 50 hole into the brass fittings. Attach the seat with no. 2 button-head socket screws through the dowels into the brass fittings. Removing the screws will allow you to

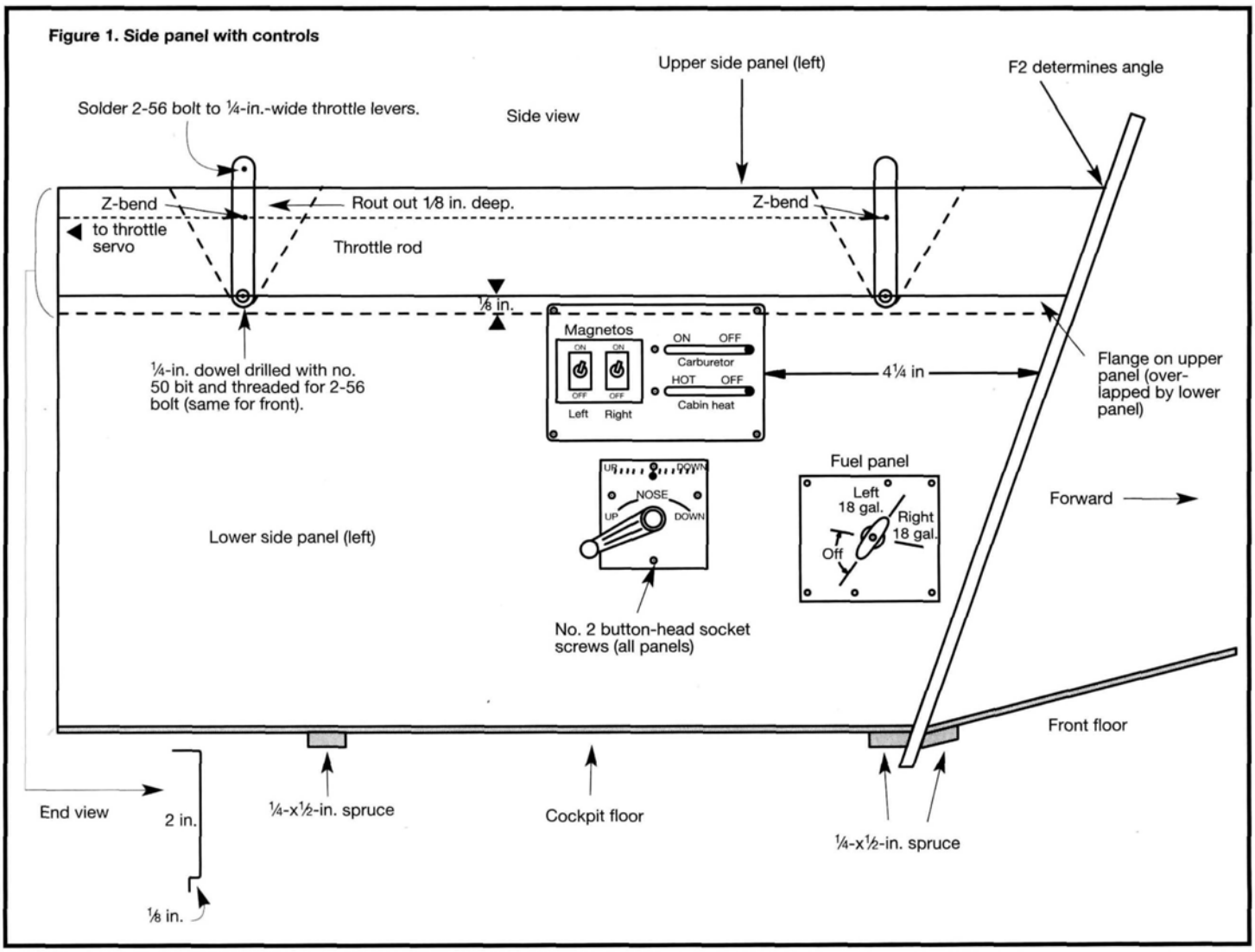
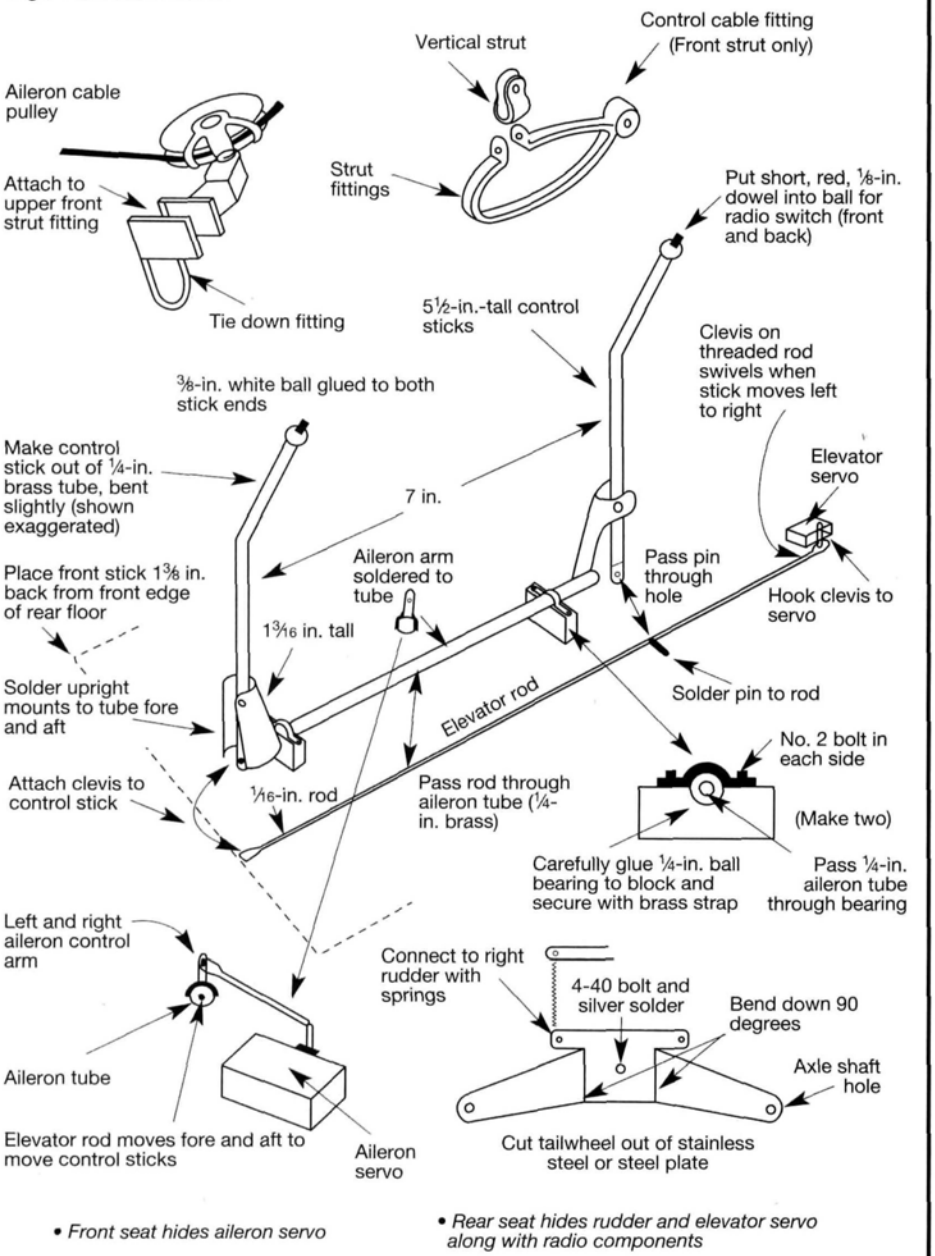
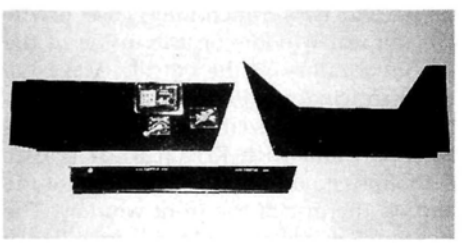
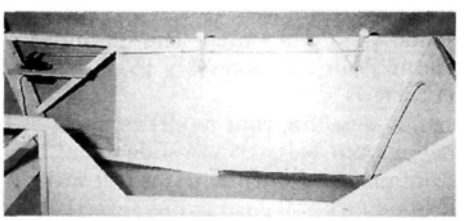


Figure 2. Control sticks





The ⅓-scale Cub's panels ready for installation.



A servo pushrod connects to each of the throttles for realistic action.

remove the rear seat for access to the radio compartment. With CA, attach black vinyl to the top dowel, and pass it downward under the bottom dowel then over and around the lower front dowel. This completes the bottom. Sew black vinyl covers onto ½-inch foam for the seat cushions, and attach them to the seats with hook-and-loop fastener.

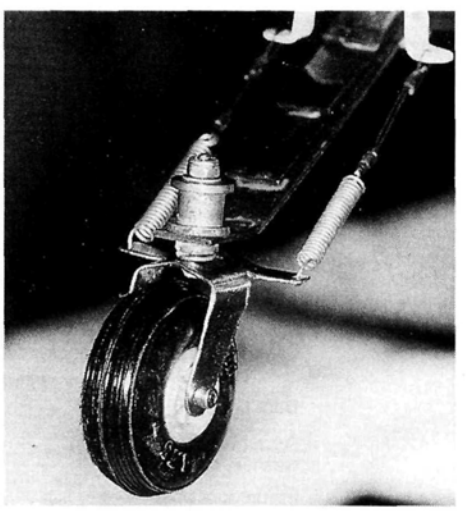
DOOR LATCH

The door latch is shown in Figure 5. Form a door handle out of a piece of 3⁄32-inch brass wire and let it extend into the door to form the pivot pin. Cut an actuating arm out of a piece of ¼-inch, flat brass stock. Drill three 1⁄16-inch holes in the arm—one in the center and one near each end. Solder the handle—bent 90 degrees toward the actuating arm and parallel to the door top—into the center hole.

When you have built the door, install the vertical brace 7½ inches in from the top front of the door. It is made of two pieces of 1⁄16-inch ply. Cut the brace so the door will fit, then drill a 1⁄16-inch hole in it so the actuating arm will fit with about ⅛ inch clearance at the top. To prevent the door-handle shaft from moving in and out, solder two washers on each side of the actuating arm. Slip a vertical ply brace over the handle and place it next to the washer; place the other over the outer shaft and glue them both into place on the door.

Make two 1⁄16-inch-wire door-latch arms with small metal clevises on the inside and attach them to the actuating arm. Run a small, moderately tensioned spring from the clevis on the lower actuating arm to the top door stringer. When you move the door handle down, the latches move in to allow the door to open.

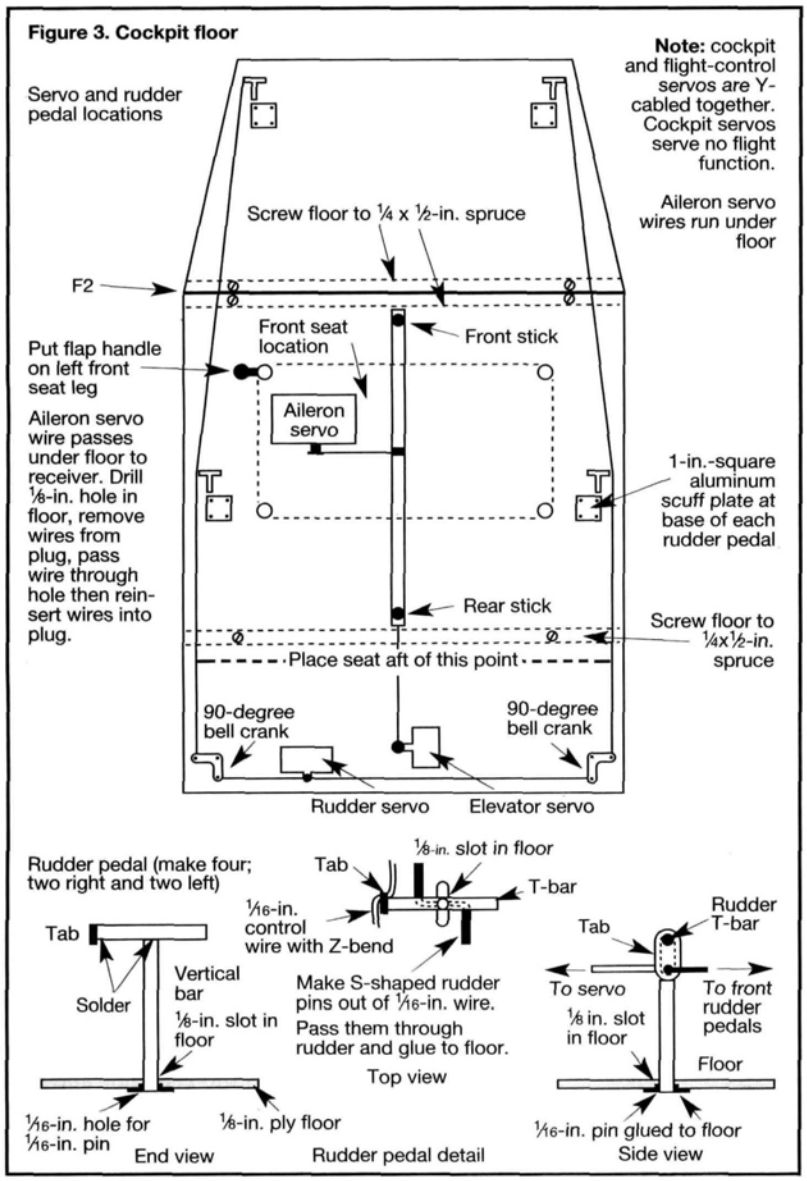
For the upper window latch, use a ball joint on a threaded post and situate it 6 inches back from the front of the window. When you install the right wing, open the window and mark the spot at which the ball hits the bottom of the wing. Glue a 1x1-inch, 1⁄32-inch-thick ply plate to the wing here. Take a 5⁄16-inch length of neoprene fuel line (which should fit snugly over the ball joint) and CA it to a small piece of dowel that fits the tubing tightly. Leave ¼ inch of the tubing open to receive the ball joint. Drill a hole in the 1-inch-square ply sheet, and insert the dowel in the hole so that the neoprene tubing rests against the plate. CA the dowel into place. When you open the window, the ball joint will be plugged into the neoprene and will hold the window open.

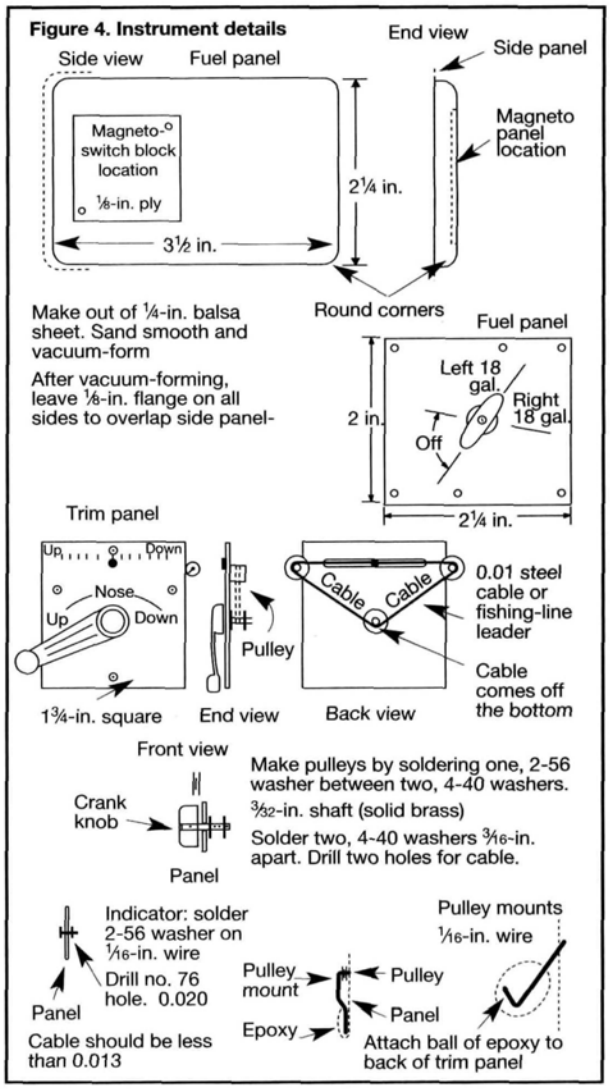


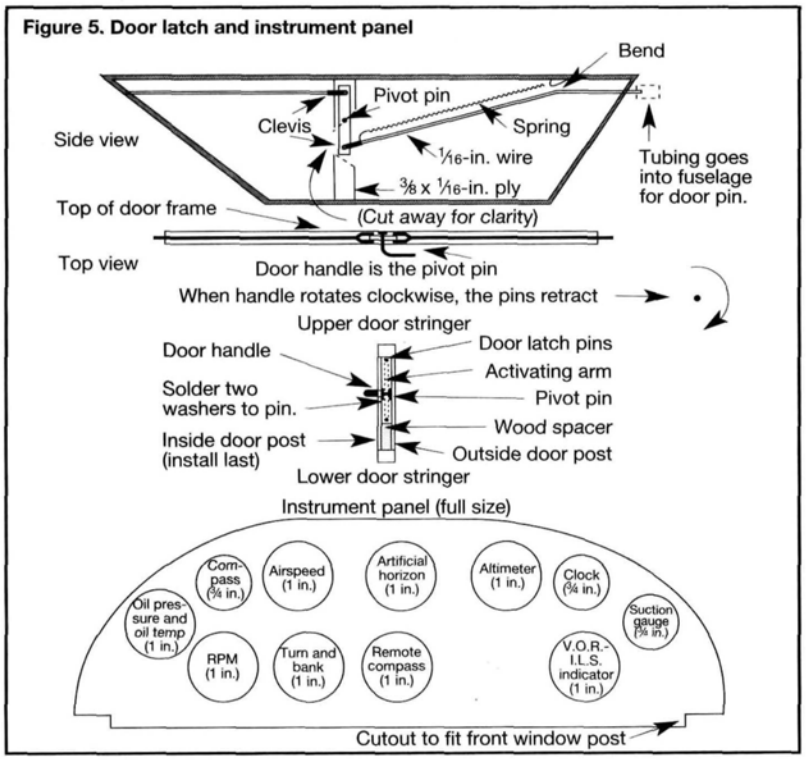
With modifications, the tailwheel can be made to scale.

TAILWHEEL

Figure 2 includes a pattern for a realistic tailwheel. Cut and bend it as shown. It is best to use stainless steel for this assembly, but you can use steel plate as well. With a torch, silver-solder a 4-40 bolt in the center and secure it to a C.B. Associates* tailwheel with a fiber locknut.







SLIDING WINDOW

To make the sliding window, first assemble a frame out of ⅛-inch brass channel. The frame should be 9¾ inches long and 5 7/16 inches from top to bottom. It fits on the left side between the two vertical window posts that must be squared and parallel to each other. Solder the four corners of the frame and glue the frame into place, leaving it flush on the outside. Out of the material included in the kit, cut two, 5-inch-long, clear plastic windows. Install the rear window on the inside of the frame and the front window on the outside. Make 5/16-inch-wide fore and aft window stiffeners out of thin aluminum folded in half and squeezed into the plastic windows. You can glue them with Kristal Klear plastic cement. These stiffeners go on the front and back of the rear window and on the rear of the front window. The front of the front window needs an added ⅛-inch flange for the inside and outside of the stiffener, so bend the flanges first, then fold them in the middle. Install them in the front of the front window. This allows the window to easily slide open and closed. The sliding windows and working door are necessary to access the wing-attachment screws.

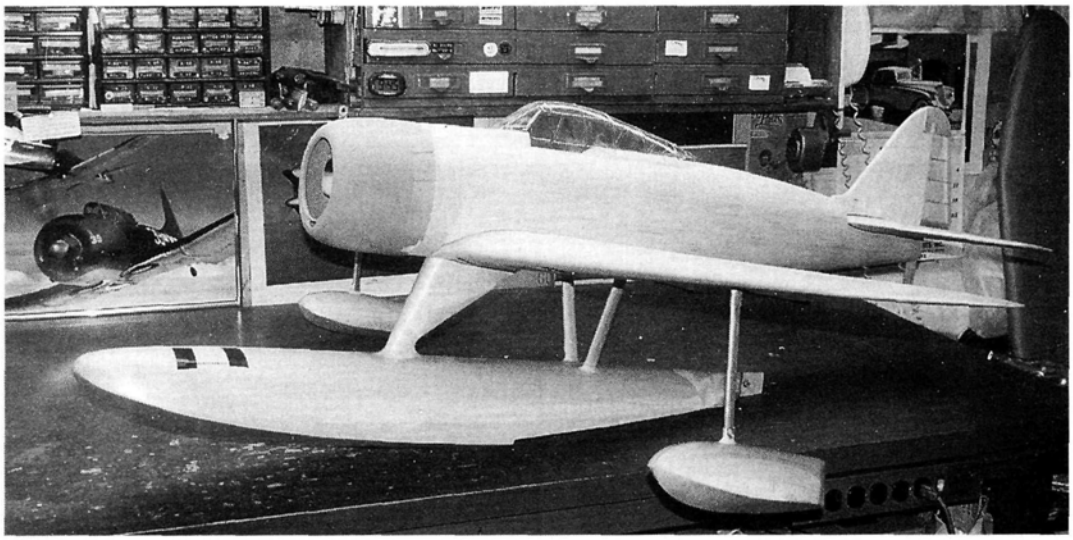
I hope you enjoy detailing your model as much as I did mine. Detailing your Balsa USA ⅓-scale Super Cub will take time and patience, but the result will make it all worthwhile. Good luck and great flying.

**Addresses are listed alphabetically in the Index of Manufacturers on page 198.*

Strip-plank a fuselage

Combating compound curves by John Tanzer

Other modelers often ask how I strip-plank a fuselage with compound curves. Do you have to taper each plank to the rear of the fuselage? No, my method is quite simple: I divide the fuselage into four sections and then glue and pin a strip at the belt line halfway between the top and the bottom sections. Then I glue and pin a strip at the center of the bottom section.

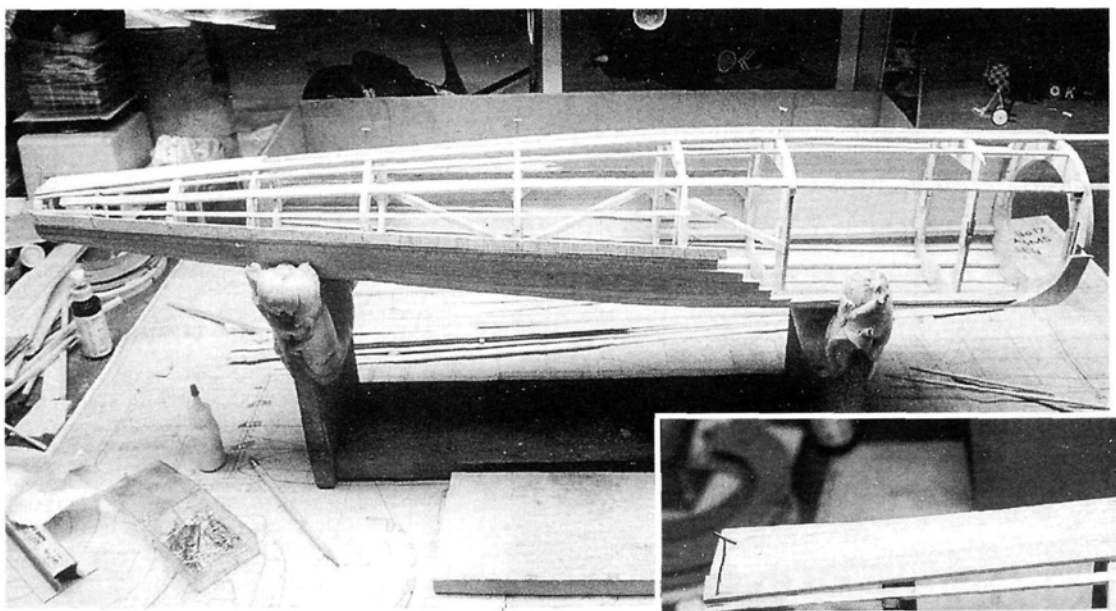


From then on, I simply glue on one strip at a time (one strip up, and one strip down) till they meet at the rear. I then cut the rear of the strips to fit. I do the rest of the sections in the same way, alternating one up, one down, till the section has been filled in.

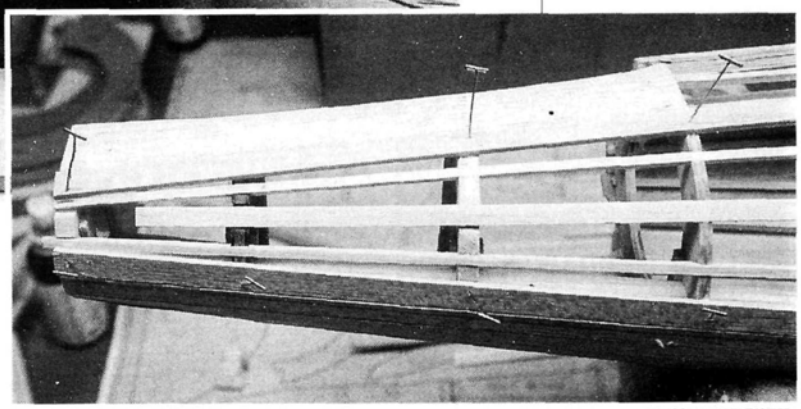
On my .60-size Zero shown here, I used 3/32x3/8x36-inch-long balsa strips. If some of the strips were too short, I spliced on an additional piece.

I use aliphatic resin glue because it allows more time to work, and it's easy to sand; just let it dry for 48 hours before you block-sand with 80-grit sandpaper. Do not sand too briskly, as the heat generated can soften the glue and gum up the sandpaper. Fill any low spots (you're bound to have some) with Elmer's light wood filler.

Using this system, I find strip-planking quite enjoyable. The photos show it in detail and are very clear, so why not try it on your next model?

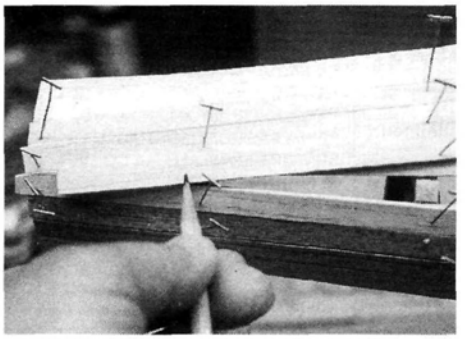


1 *To ease the planking process, place the fuselage in a cradle or some kind of padded holder. Here, the left side has been planked, and the right side is ready to be planked. Begin by adding one strip at the belt line and another strip at the bottom center.*

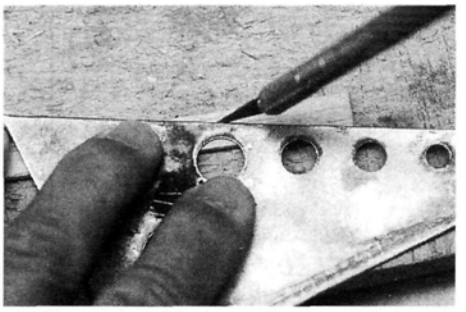


2 *For this Zero, I first glued on the 3/32-inch sheet balsa saddle for the stabilizer. Note that a 3/32x3/8-inch strip has been glued to the fuselage belt line, and another has been glued to the bottom center.*

PHOTOS BY JOHN TANZER

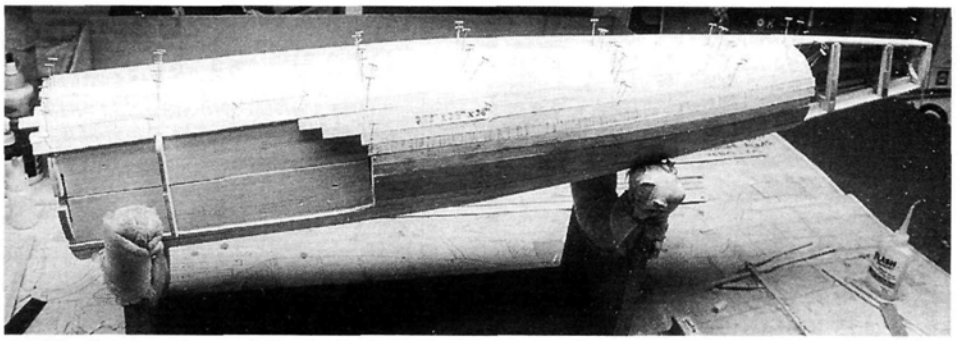


3 *As I add strips between the belt line and the bottom strip, their ends come together at the rear of the fuselage. To fit the remaining strips, mark the strip's ends where they overlap the previous strips for the angle cut. When you apply strips, alternate one up and one down.*

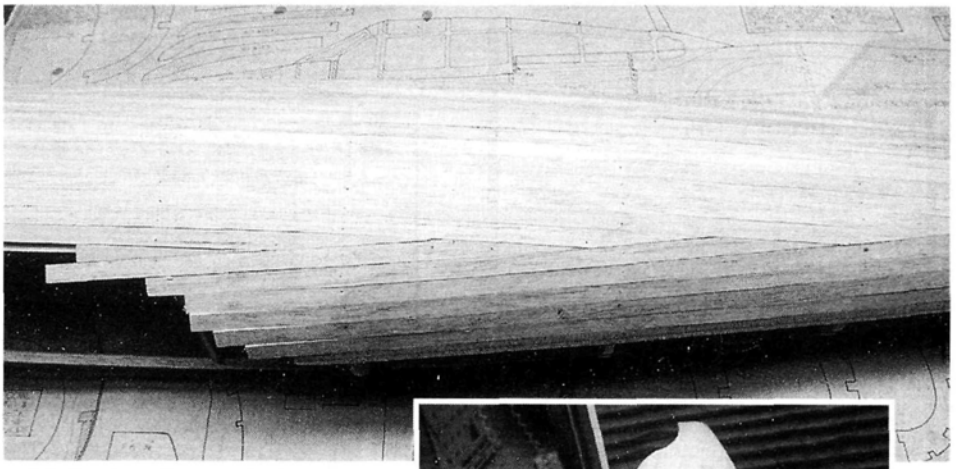


4 *Use a straightedge and cut each balsa strip at the mark. Fit each strip into place, and check its fit against the other strips.*

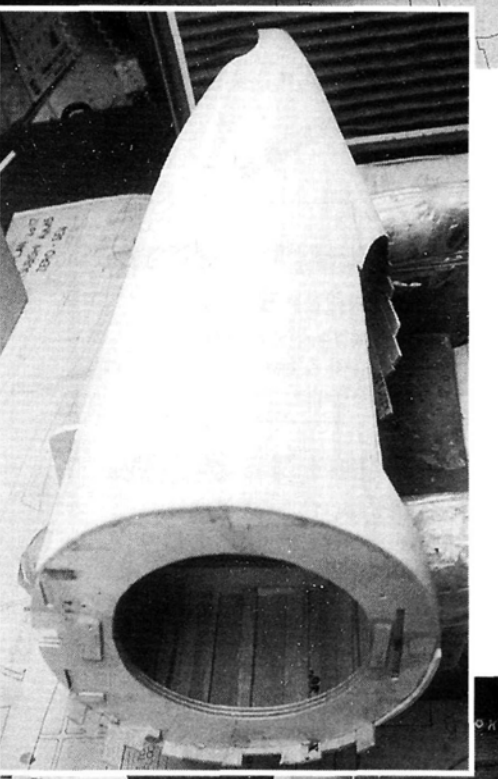
5 *When the strips are added alternately (one up, one down), the angles on their cut ends create a herringbone effect. The joints that the angled cuts form are very strong and are almost invisible when they've been sanded.*



6 *The fuselage is now fully planked. Notice that as the joints are placed closer to the front of the fuselage, the strips become shorter.*

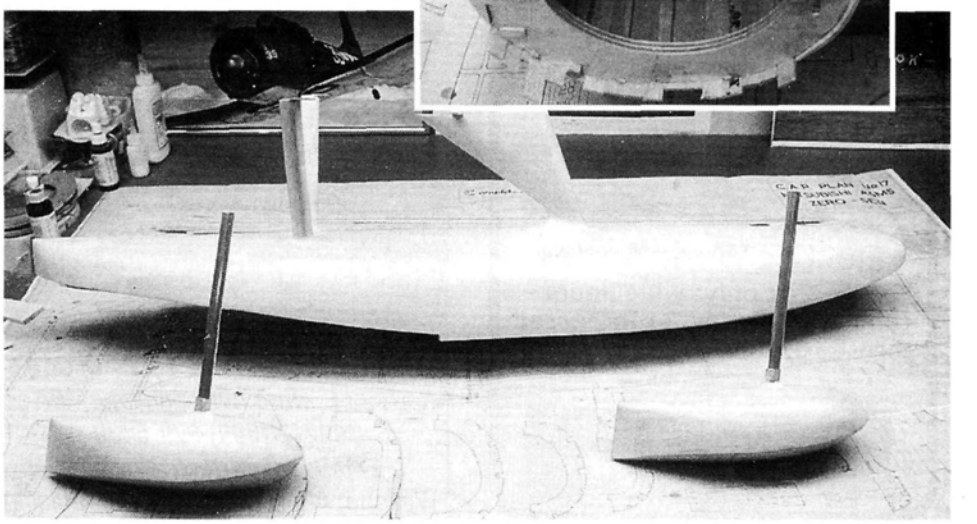


7 *Notice the difference between the top and the bottom of the fuselage. The top has been block-sanded with 80-grit paper, and the bottom remains unsanded. Aliphatic-resin glue is easy to sand and is perfect for adding planking to fuselages.*



8 *Here, the Zero fuselage has been sanded and is very smooth. Hardly any filler is required if you make neat, precise joints.*

9 *These floats for the Navy version of the Japanese Zero "RUFE" were also strip-planked in the same way as the fuselage. Structures of any shape can be planked using this system.* ✈



NAME THAT PLANE

Can you identify this aircraft?

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Congratulations to David G. Childers of Hartselle, AL, who correctly identified our November '99 mystery plane, the Grumman JRF/G-21. The "Goose," as it was named by the RAF, flew for the first time in June 1937. The eight-seat G-21 was Grumman's first effort to produce an aircraft for both the private and commercial markets. The plane was given resounding approval and captured the fancy of the military. Variants of the G-21 would see action with the Navy, Coast Guard, Army Air Force, Royal Canadian Air Force and the Royal Air Force. Consider-ing the Goose's top speed of 240mph and cruising range of 1,600 miles, it's little wonder that the nearly 51-foot-span amphibian remained in production through September of 1945.

The winner will be chosen four weeks following publication from correct answers received (delivered by U.S. mail) and will receive a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free, one-year extension of his subscription.

Index of Manufacturers

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Ace Hobby Distributors, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037; (660) 584-7121; fax (660) 584-7766.

Aeroloft, 7919 E. Mawson Rd., Mesa, AZ 85207; (602) 649-8662; fax (602) 649-8649; www.aeroloft.com.

AMT, Rt.2, Box 154A, Williamstown, WV 26187; (304) 375-3777; fax (304) 375-6362.

Balsa USA, P.O. Box 164, Marinette, WI 54143; (906) 863-6421; fax (906) 863-5878.

BMT (Baird Micro Turbines); distributed by Desert Winds RC (address below) and A-1 Hobby (address above).

B&T R/C Products, 508 Lake Winds Trail, Rougemont, NC 27572; (919) 471-2060.

Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058.

Bob Smith Industries, 8060 Morro Rd., Atascadero, CA 93422; (805) 466-1717; fax (805) 466-3683.

Bob Violett Models (BVM), 170 State Rd. 419; Winter Springs, FL 32708; (407) 327-6333; fax (407) 327-5020; www.bvmjets.com.

Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651; (773) 626-9550; fax (773) 626-9566.

C.B. Associates; distributed by C.B. Tatone.

C.B. Tatone Inc., 21658 Cloud Way, Hayward, CA 94545; (510) 783-4868; fax (510) 783-3283.

Central Hobbies, 1401 Central Ave., Billings, MT 59102; (406) 259-9004; fax (406) 259-4744.

Cermark Electronics, 107 Edward Ave., Fullerton, CA 92833; (714) 680-5888; fax (714) 680-5880.

Cheetah; distributed by Reid's Quality Model Products.

Cobra; distributed by James Engineering (Turbines) Ltd.

Custom Electronics, Box 123, Higginsville, MO 64037; (888) 584-6284; fax (888) 584-6285.

Dave's Aircraft Works, 34455 Camino El Molino, Capistrano Beach, CA 92624; (949) 248-2773; www.davesaircraftworks.com.

Desert Winds RC, 936 F Ave., Douglas, AZ 85607; (520) 805-0814.

Dremel Tool, 4915 21st St., Racine, WI 53406; (414) 554-1390; fax (414) 554-7654.

Dynamic Balsa and Hobby Supply, Box 107, Leonore, IL 61332; (815) 856-2272; fax (815) 856-2270.

E. H. Yost & Co., 2211 D Parview Rd., Middleton, WI 53562; (608) 831-3443; www.mrnicd-ehyostco.com.

EMS, 22605 E. LaPalma Ave., Ste. 516, Yorba Linda, CA 92887; (714) 692-1393l; fax (714) 692-1330.

F&M Enterprises, 22522 Auburn Dr., El Toro, CA 92630; (714) 583-1455; fax (714) 583-1455.

FMA Direct, 9607 Dr. Perry Rd., Unit 109, Ijamsville, MD 21754; (800) 343-2934; fax (301) 831-8987; www.fmadirect.com.

Futaba Corp. of America, P.O. Box 19767, Irvine, CA 92723-9767; (949) 455-9888; fax (949) 455-9899.

Gerard Enterprises Inc., 13435 Rosewell Dr., Brookfield, WI 53005; (414) 784-4510; (414) 784-4520.

Golden West Models LLC, 16520 Arminta St., Van Nuys, CA 91406; (818) 781-7364; fax (818) 781-4112.

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

Hangar 9; distributed by Horizon Hobby Distributors.

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948; www.hobby-lobby.com.

Hobby Shack, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (800) 854-8471; fax (714) 962-6452.

Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511; www.horizonhobby.com.

Ikon N'West, 3806 Chase Rd., Post Falls, ID 83877; (208) 773-9001.

Indy RC, 4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; (217) 352-1913; fax (217) 355-1552; sales @indyrc.com; www.indyrc.com.

Jaccio Products, P.O. Box 4310, West Hills, CA 91308; (919) 716-0310.

James Engineering (Turbines) Ltd., 5 St. Johns Rd., Clevedon, Bristol, B521 7TG England.

JB Weld Co., P.O. Box 483, Sulphur Springs, TX 75482; (800) 784-8770.

Jet Cat; distributed by Golden West Models LLC.

J.P. Products, 4411 Bee Ridge Rd., Ste. 297, Sarasota, FL 34233; (941) 922-6300; fax (941) 923-8899.

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JR, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511; www.horizonhobby.com.

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LDM Industries Inc., P.O. Box 292396, Tampa, FL 33687-2396; (813) 991-4277; fax (813) 991-4810.

Master Airscrew; distributed by Windsor Propeller Co.

MDS Engines, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511; www.horizonhobby.com.

Miniature Aircraft USA, 3743 Silver Star Rd., Orlando, FL 32808; (404) 292-4267.

Model Specialties, 1220 Sylvan Rd., West Chester, PA 19382; (215) 692-4139.

Moki; distributed by Gerard Enterprises Inc.

Morgan Fuels; a division of Morgan Inc., P.O. Box 1201, Enterprise, AL 36331; (205) 347-3525; fax (205) 393-4852.

Nelson Hobby Specialties, 394 SW 211th Ave., Aloha, OR 97006; (503) 629-5277; fax (503) 645-1492.

New Creations R/C, P.O. Box 496, County Line Rd., Willis, TX 77378; phone/fax (409) 856-4630; www.newcreations-rc.com.

O.S.; distributed by Great Planes; www.osengines.com.

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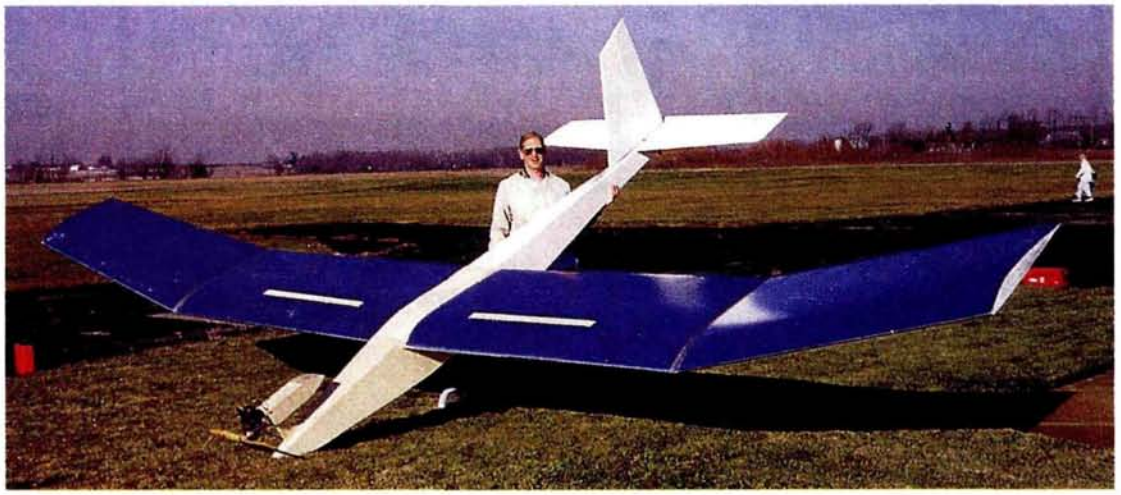
BY TOM KRAPP

A 25-foot gentle giant

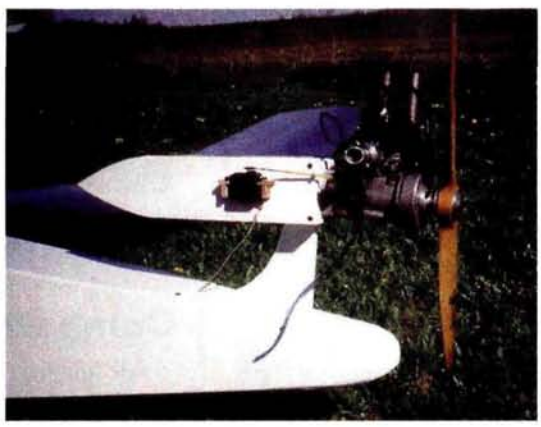


Almost 20 years ago, I began flying radio control model aircraft. My first plane was a Carl Goldberg Eaglet 50, and I've had many other powered aircraft. But as much as I enjoy designing, building and flying these models, I've always had a soft spot for gliders. So in 1981, I purchased a Carl Goldberg Gentle Lady. Ever since then, I've flown it off hills, power pods, high starts and Lake Michigan's sand dunes, as well as by winch and piggyback off my Eliminator 40 and Big Eliminator planes.

As the years went by, I had an increasing urge to design and build a 25-foot glider, but every time I looked at the cost of building this monster, I put the project on hold. There is an inexpensive and easy way to do it, though: just use ½-inch foam for the wing skin.

I originally thought of putting brown paper over the wing, but I later found foam with brown paper and silver foil already applied to use. To complete the 25-foot-span wing, I needed eight sheets, so I bought nine—just in case—because they only cost $6.50 apiece. I also picked up a plain sheet of ¾-inch foam for the ribs, supported by Russian birch ply along with ½x⅜-inch maple for the spars. I then grabbed furnace tape at Wal-Mart and spray adhesive from a lumber company. Using these materials, I put together a 25-foot wing for about $80.

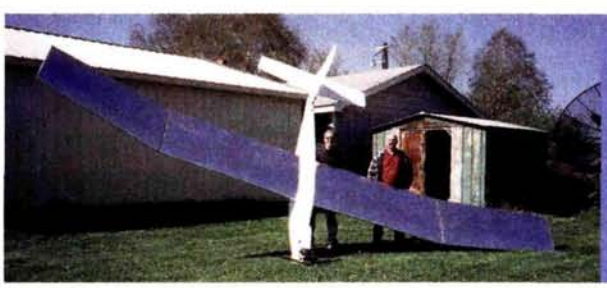
The fuselage is ⅛-inch Russian birch ply and lite-ply, and the stabilizers are ⅝-inch balsa and maple. I knew that I would need to be able to transport this monster, so I designed a four-piece wing and a two-piece fuselage with removable stabilizers. Four brass hinges with bolts going into 6-32 T-nuts and locknuts soldered to the backs hold the fuselage together. I also used a 6-32 threaded rod that I glued into the vertical stabilizer and passed through the horizontal stabilizer and fuselage into nuts on the bottom. I also included boost tabs on the rudder and elevator.



One of the most interesting phases of the glider's development was the stress test for the wing. For my test, I clamped one of the inside wing panels to my workbench using a thick board and an 80-pound bag of cement for counterbalance. Then I loaded up the wing with 50 pounds of plywood. It bent ¼ inch and tilted my workbench four inches—success!

Six weeks after starting this project, I was ready for the first flight. I loaded up the truck and headed to the airport. It was a cold, cloudy day with low ceilings and 20mph winds gusting to 25mph. My dad, my friends and I put the glider together but had some trouble putting enough air pressure into the Du-Bro 6-inch tire that held up the 54-pound glider. A friend got a big tire nipple and put it on the end of my pump then used an air bottle to fill the tire. We put the glider at the end of the takeoff spot and started up the Quadra 50. A friend held the wingtip as I advanced the throttle. Fifty feet down the runway, the glider leapt into the air flapping its massive wings like a bird. The air was very bumpy, and it looked as though the dihedral braces were flexing a little, but after getting about two or three hundred feet up, the air smoothed out, and the glider flew great with no trim adjustments. I came down for a flyby and again the wings flapped, so I went back up. When I saw a cloud go under the glider, it reminded me that this was not your standard two-meter glider, and I knew I had to be more mindful of the altitude. I came down after 15 minutes. We saw the huge shadow of the 66.5-square-foot wing on the ground, and it came in for a perfect landing.

I am in the process of putting carbon fiber on the dihedral braces and a bigger servo on the elevator, but besides these minor modifications, I don't need to do anything to make this monster fly like a 747-size Carl Goldberg Gentle Lady.



SPECIFICATIONS

Wingspan:	25 ft.
Chord length:	34 in.
Fuselage length:	12-plus ft.
Weight:	54 lb.
Power:	Quadra 50
Horizontal stab.:	75 in.